THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1911.] LONDON, DECEMBER 26, 1899. [51ST YEAR. PRICE 6d.

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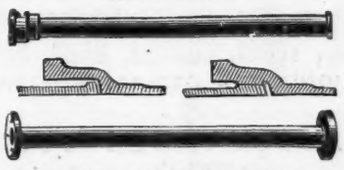

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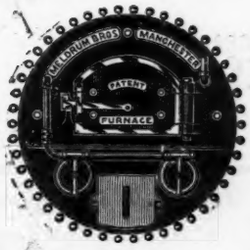

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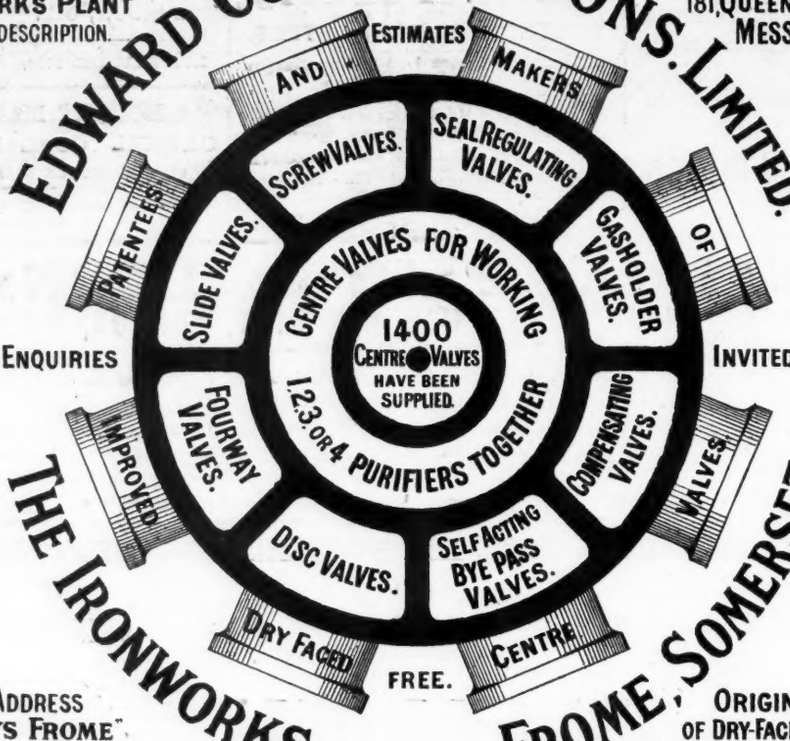

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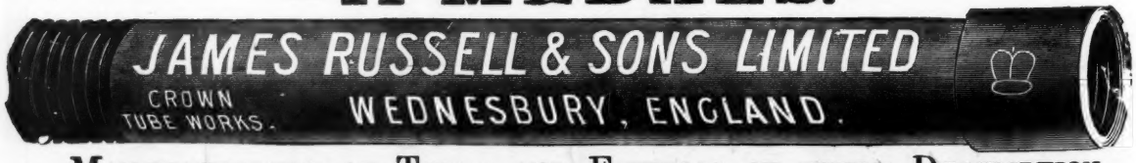

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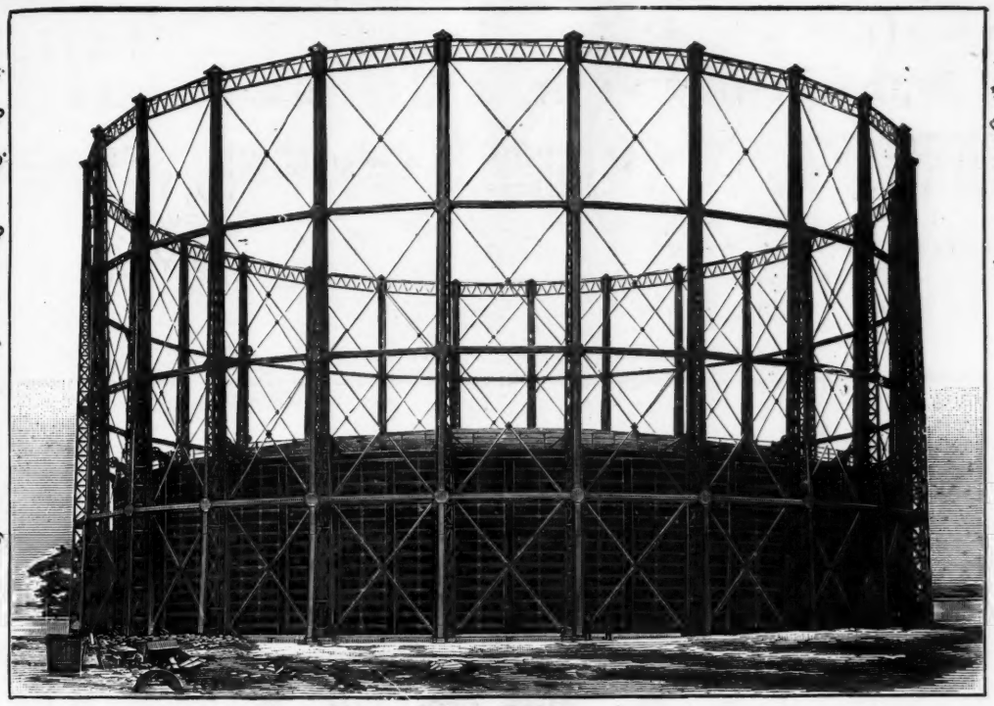

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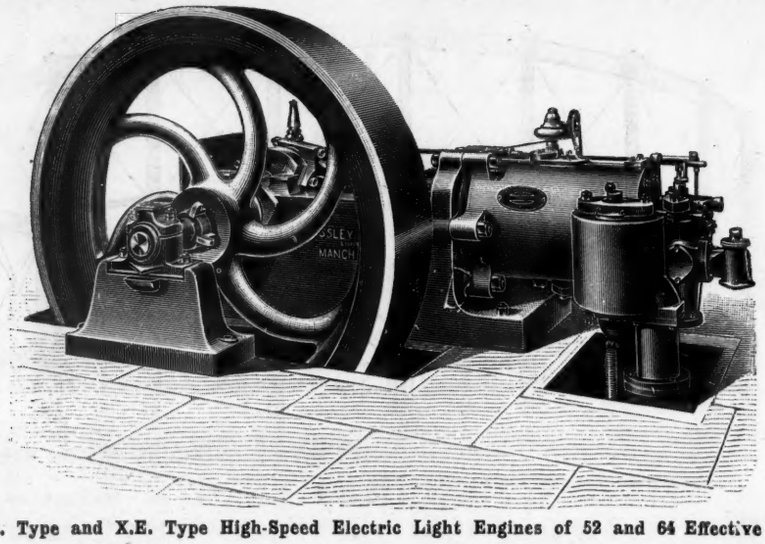

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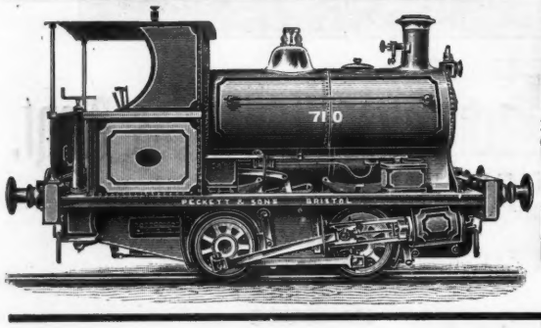

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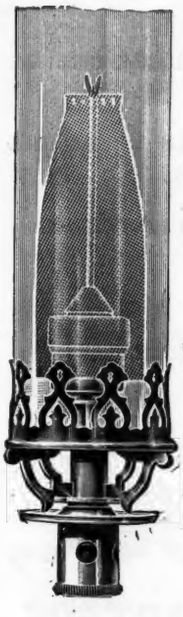

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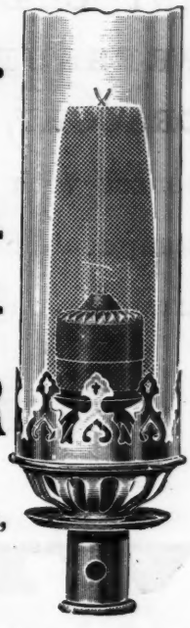

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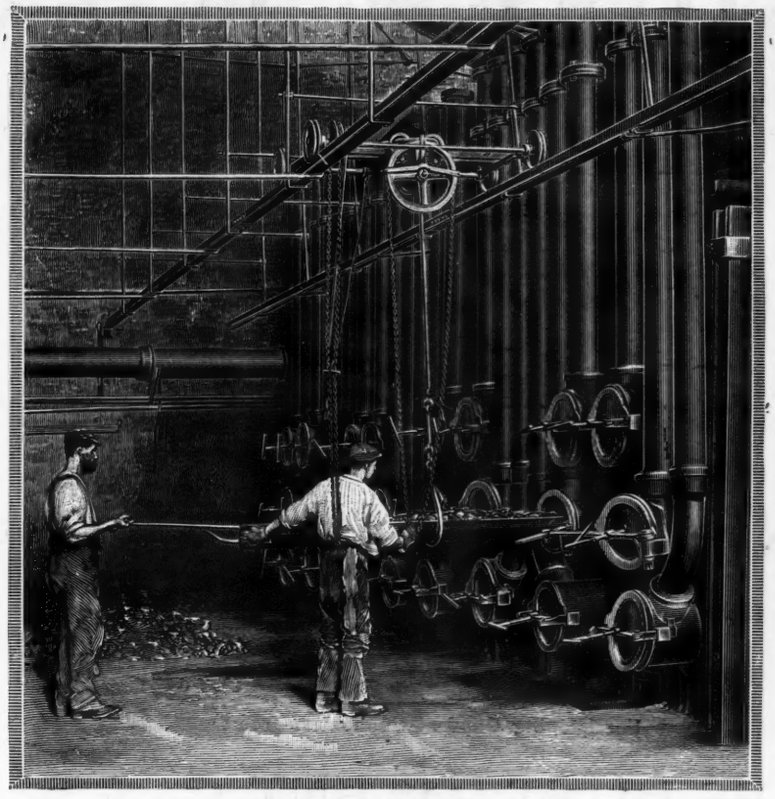

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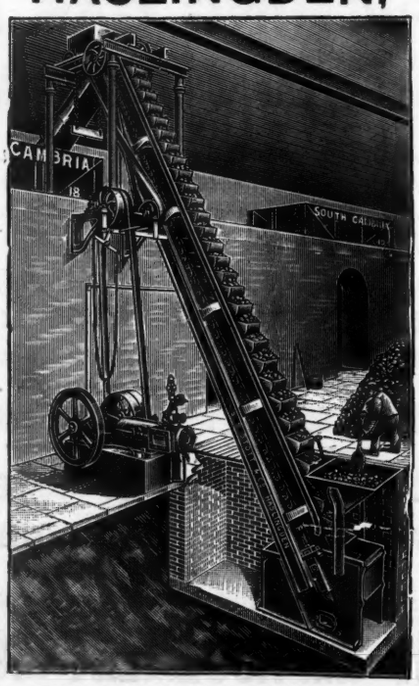

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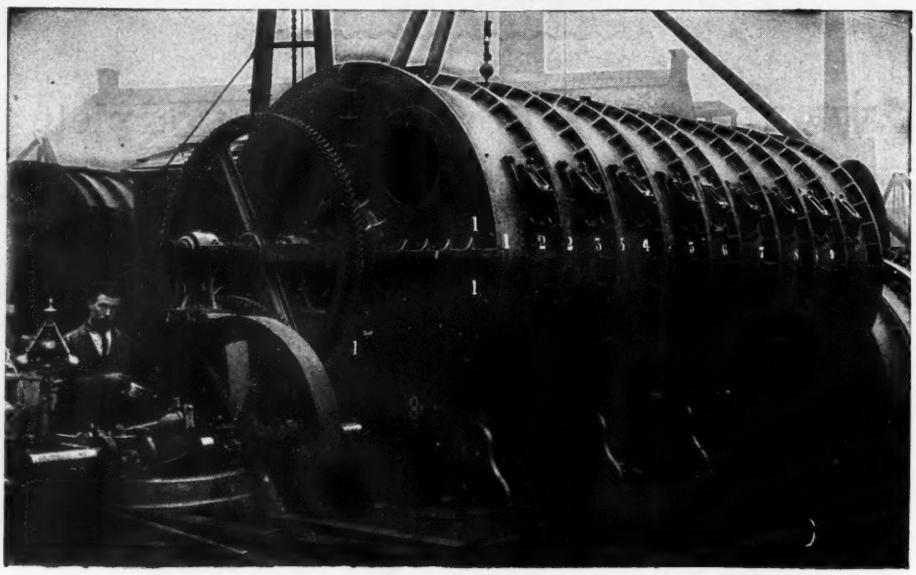

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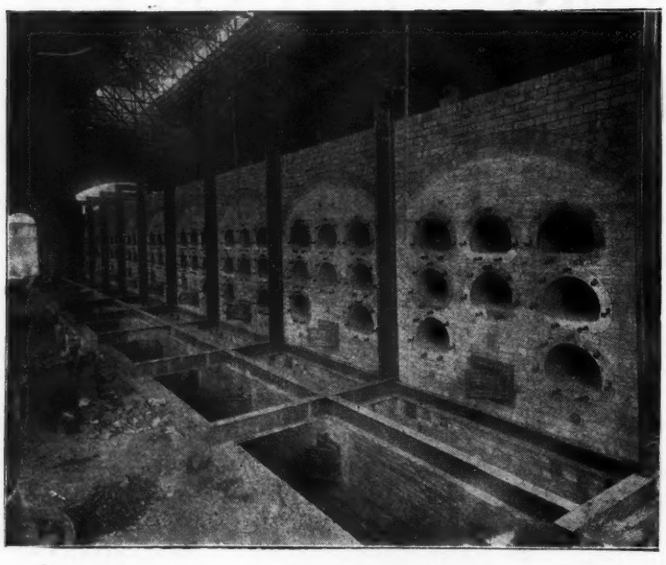

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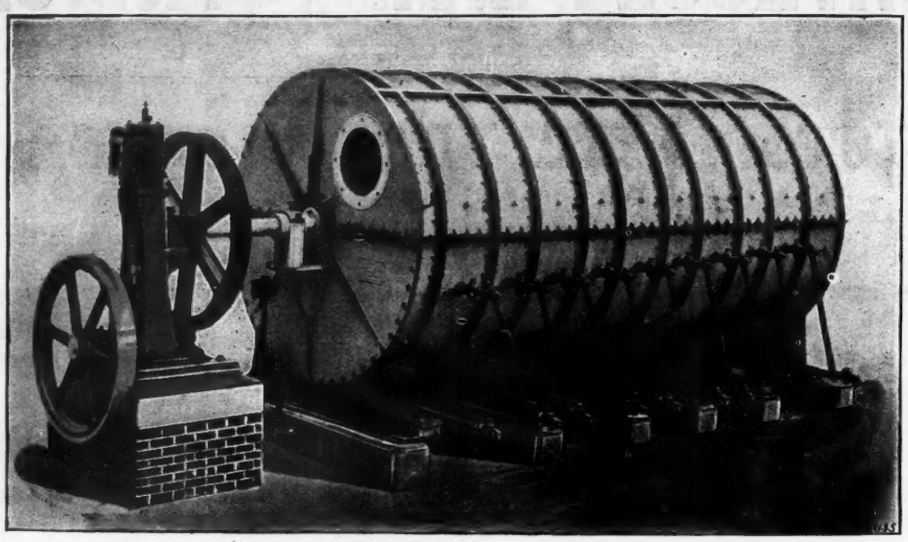

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Tottenham (Second Contract)	750,000
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Swansea	750,000
Manchester	3,000,000
Brighton	1,750,000
Preston	1,500,000
New York	1,200,000
Southport	750,000
Bath	1,000,000
Newburgh, N.Y.	350,000
Newburgh, N.Y. (Second Contract)	250,000
Hoylake	125,000
Coventry	600,000
Coventry (Second Contract)	600,000
Bordentown, N.J.	125,000
Winchester	200,000
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Stockport	500,000
Norwich	1,000,000
Holyoke, Mass.	600,000
Lea Bridge	350,000
Lea Bridge (Second Contract)	350,000
Stockton-on-Tees	500,000
St. Joseph, Mo.	750,000
Edinburgh	2,000,000
Guildford	350,000
Brentford	1,200,000
Bridlington	125,000
Syracuse, N.Y.	850,000
Middlesbrough	1,250,000
Croydon	1,250,000

	Cub. Ft. Daily
Commercial Gas Co.	850,000
Commercial (Second Contract)	850,000
Commercial (Third Contract)	1,250,000
L. & N.W. Railway, Crewe	700,000
Taunton	225,000
Lawrence, Mass.	400,000
Rotterdam	850,000
Dorking	125,000
McKeesport, Pa.	500,000
The Gaslight and Coke Co., Bromley	3,750,000
The Gaslight and Coke Co., Nine Elms	2,750,000
Durham	200,000
New York (Remodelled)	11,000,000
Scarborough	800,000
Perth, W.A.	125,000
Bremen	550,000
Maidenhead	225,000
Epsom	225,000
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Wandsworth and Putney	1,800,000
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Falmouth	150,000
Southampton	800,000
Hartlepool	750,000
Utrecht	1,000,000
Deventer	150,000
Portsmouth	1,000,000
Bournemouth	1,000,000
Aylesbury	150,000
Hamburg	1,750,000
Dublin	2,000,000
Redhill	275,000
Posen	450,000
Dunedin (N.Z.)	150,000
Stockport (Second Contract)	500,000
Brighton (Second Contract)	1,750,000
Croydon (Second Contract)	625,000
Maidenhead (Second Contract)	225,000
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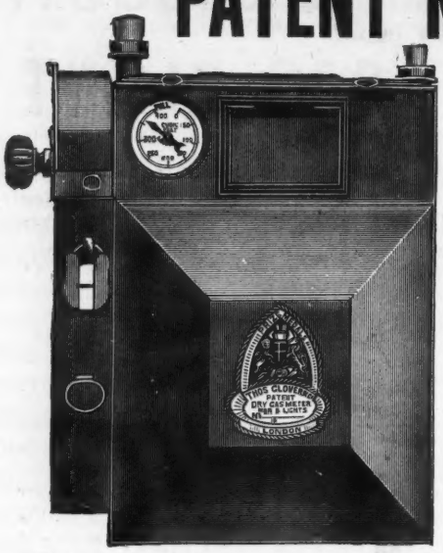

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[See also Advt. on last White Page.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE.

A Retrospect of the Year 1899 1539

WATER AND SANITARY AFFAIRS—

The Principal Events of the Year 1899 1543

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market 1545

Electric Lighting in 1899—A Retrospect 1545

Employers and the War 1547

Wages and Prices in the Iron and Steel Trades 1547

Pauperism and Old-Age Pensions 1547

NOTES:—

Steam Raising and Boiler Fuels 1549

Pitch and Tar in Road Making 1549

Ventilation and Gas-Fires 1549

The Inventor of the Steam-Blast for Locomotives 1549

Colour Temperatures 1549

TECHNICAL RECORD:—

Association of Municipal and County Engineers—Mr. T. F. Harvey on the Merthyr Water-Works 1549

The Cost of Producing Carbide by Different Agenci s 1551

REGISTER OF PATENTS:—

Acetylene Generators—Ellen, W. 1552

Time Measure for Gas Stoves and other Lighting with Coin-Freed Mechanism—Glover, R. T. & J. G. 1552

Incandescent Burners and Mantle-Supports—Duncan, J. H. H. . 1553

Gas-Burners—Mills, B. J. B. ("La Société Anonyme des Fontaines à Gaz"). 1553

Coke-Breaking Machine—Stevenson, S. 1554

Producing Carburetted Air—Mills, B. J. B. ("La Société Anonyme des Fontaines à Gaz") 1554

Explosion Engines—Smith, F. H. 1554

Gas-Producers—Taylor, M. 1554

Combined Gas and Blowing Engines—Thwaite, B. H., Gardner, F. L., and Hartley, S. 1554

Obtaining Cyanogen Combinations from Coal Gases—Teichmann, H. 1554

Patent Notices 1555

CORRESPONDENCE:—

The Consumption of Water per Head in Different Towns . . . 1555

LEGAL INTELLIGENCE:—

Supreme Court of Judicature—Court of Appeal—The Welsbach Incandescent Gas-Light Company, Limited, *v.* The Daylight Incandescent Mantle Company, Limited. 1556

Grouping Houses for Water Supply 1556

Singular Water Supply Dispute 1556

Disputed Consumption of Gas on the Prepayment System . . . 1557

Audacious Thefts from Gas-Meters by Boys 1557

MISCELLANEOUS:—

Destructive Fire at the Sheffield Gas-Works—The Chemical Works at Grimesthorpe Ablaze 1557

Manchester Corporation Gas Supply 1557

Electric Lighting Notes 1558

Meeting of the Chelsea Water Company 1559

Gas and Water Companies' Stock and Share List. 1559

The Yeo Valley Reservoir of the Bristol Water-Works 1560

Notes from Scotland. 1562

Current Sales of Gas Products 1563

Coal Trade Reports 1564

PARAGRAPHS:—

OBITUARY: Mr. John Williams; Sir Richard Thorne Thorne, K.C.B.; Mr. Horatio Brothers, M.Inst.C.E. 1548

PERSONAL: Mr. C. B. Newton, F.C.S.; Mr. H. William Chisholm; Mr. G. Dunbar Malam 1548

Professor H. B. Dixon on the Explosion of Gases 1545

The Kent Coal-Boring Operations—Transactions of the Gas Institute—Continuous Process for the Production of Calcium Carbide—Ten Years' Working of the South Metropolitan Gas Company's Profit-Sharing Scheme 1546

London's Indebtedness—Society of Engineers 1548

Extensions at the Stafford Gas-Works 1561

The Lighting of Hillesley by Acetylene—The Lighting of Singapore—The Duration of Scottish Coalfields—Suffocated by Gas Fumes—Bradford Corporation Bill—Inclined Retorts at the Ilford Gas-Works—Water Supply for a Cheshire Township 1565

Gas Workers' Wages at Hinckley—The Gas and Allied Trades Exhibition—The Huddersfield Corporation and the Water Engineers' Association—Large Gas Consumption in Birmingham—Bilston Gas Company 1566

TO CORRESPONDENTS.

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EDITORIAL NOTES.

A Retrospect of the Year 1899.

WITH the present number, the second volume of the "JOURNAL" for the year 1899 is completed; and we therefore take the opportunity, as usual, of giving a glance backwards over the year's history, as it has been told in our pages week by week. Little was it to have been expected, twelve months ago, that the year which opened so fairly with great promise of the continued advance of the British Empire in peaceful enterprise and industry, would ere its close see this Realm grappling with a bitter enemy which it had nursed into wealth and power. Less than a year—six months—ago, there was hardly a sane man speaking the English language who dreamt that the Dutch Republics of South Africa would dare to assault the British Empire, invade its territories, and set its forces at defiance. We had all acquired the habit of thinking that the counsels of the Empire are so guided and governed in the interest of the orderly development of trade and industry, and for the establishment of justice and fair dealing as between man and man the world over, that it was a rude awakening to learn that a people to whom we had given scope and protection for working out their own ideals of civilization, preferred staking their existence on the ordeal by battle to accepting our principles in these regards. Consequently, at the moment of writing, we see this Empire of which we are all so proud and fond, bleeding sorely from a deep wound, and at stern grips with the thankless hand that inflicted it. Not even in surveying the national industry of gas supply can one help looking through a haze of blood. This war with the South African Republics has laid upon the country a duty which men have sprung from all parts of the kingdom to perform, at the certain cost, in many instances, of their lives. For the first time since its creation, the Army Reserve has been called out for active service; and many a good gas stoker and workman has dropped tools and seized rifle and sword once more. The whole gas industry of the United Kingdom has felt the first incidental strain of war, and has responded to it nobly. The men have gone, or are going—nobody can yet say how many; but their employers are doing their part, and supporting the cause of the Empire in their own way. It is the blackest Christmas of this generation's experience; and there is scarcely a gas-works in the land from which some good comrade has not gone away, perhaps for ever. But it must come right in the end; albeit the end may not be yet.

The outbreak of war, or of armed rebellion within the wide dominions of the Empire, has supervened upon a period of unexampled national prosperity. Since the beginning of the year, money and most materials and commodities have been in increasing demand, and have consequently become dearer. This is an experience which never loses interest by repetition. Not since 1875 have the markets been generally so strong. The Bank Rate has been 6 per cent. for weeks; and further advances are being discussed as not improbable. In these circumstances, it is as much as could be expected that standard gas investments should continue to hold their own, with Consols dropped to several points below par. There is some small, and probably temporary, difficulty in naming a leading gas stock as a mirror of financial influences, pure and simple. All the Metropolitan Gas Companies, in various degrees, have been subjected to disturbance. Is Dublin—"far from the madding crowd"—to be taken as a typical example? Then Dublin Original Stock stands precisely where it did. Naturally, however, most gas stocks return a little more on investment now than they did a year ago. Yet as regards the secured issues the difference is nominal. This shows much confidence in gas property on the part of the moneyed public, who cannot be supposed to know all about the conditions of the industry. There is, probably, a vague but firm impression abroad that gas is keeping its standing, which is true to an extent that is hardly realized. As a matter of fact, the growth of gas consumption throughout the United Kingdom is rapid and without check. Never has there been so much gas wanted by the consumers of it for all purposes. The use of gas for lighting has undoubtedly received a new lease of life through the incandescent system, which has been so vastly improved and adapted so successfully to all grades of lighting—high power, and

for small lights; indoors and out. But it is gratifying to note that the advance of gaslight in popular favour is not limited to the incandescent style, which does not suit all purposes. What has really come to pass is that the public are no longer content, as they used to be, that all the business of life should be slowed down at nightfall, and human activities thereby made dependent on the place of the sun in the sky. The desire of civilized humanity, which is struggling for gratification, is for the correction of cosmic conditions to its own needs and aspirations. Consequently, the standard of sufficiency of artificial lighting and warming is rising. People want to work, and to enjoy themselves, as the case may be, without interference by impertinent darkness and cold; and they are pressing gas more and more into service, with a view to the attainment of this object.

Year by year, as improved gas lighting burners reduce the relative consumption of gas for this particular purpose, the use of gas for cooking and house warming increases. There has been an enormous growth of late in the number of gas-fires fixed in houses where the economy of labour and the saving of dirt and trouble are serious considerations. Already many householders of the middle class burn as much gas for cooking and warming as they do for lighting. Add to this the growing popularity of gas among the poorer class of householders, due to the prepayment and coin-freed meter systems, and the source of the stiffness of gas property stands revealed. The public knows of these influences, and backs them. What is not so generally known, however, but tends in the same direction, is the existence of an element of strength in the fact of this expansion, coupled with the facility offered by cheap capital to meet it by extension works. Much, very much, is possible for a growing business, which is not open to a stagnating concern. Additions to plant can be made on a generous, which is probably also the most economical, scale. Thus during the year the second largest gasholder in the world was completed for Birmingham—not a small thing in itself, but a far greater thing in its significance, local and general.

The gas industry, however, has had to pay more dearly than for many years before for everything besides capital which it needed to carry on with. The price of gas coal went up enormously. The quotations for contract supplies hardened from the beginning of the year; and gas managers were sorely perplexed as to whether they should close early or hold off. Before many months had passed, it became clear that more money must be paid for supplies; and many large purchases were made at an advance of 2s., or thereabouts, on last season's rates. No sooner were the big contracts settled than quotations went up with a bound, until occasional orders could only be filled at 50 and even as much as 100 per cent. advances. Worse, however, was the discovery made by many gas undertakings late in the year that deliveries of coal could not be had. Not since 1875 has there been such a shortage of coal in the country. Shipping and railway trucks have also been to seek. How some large undertakings will go through the winter, remains to be seen. With the maximum day's output coming three weeks or so before the usual time, the case of gas manufacturers with only small stocks of coal is distinctly perilous. Nor has the possession of auxiliary carburetted water-gas plant always sufficed to clear the situation of hazard. Oil suitable for gas making began to get dear before coal rose; so that for a season it looked as though the economic recommendation of carburetted water gas was imperilled. The jump in coal, however, put matters level again, although often at an awkward eminence. Naturally, coke sold well—almost too well, indeed, for gas managers who like to have a fair quantity in stock. The course of the other gas-works residuals has been very different of late from what it was at the time of the last coal famine. Tar suffered throughout the year from the depreciation of benzol and the almost worthlessness of anthracene. Sulphate of ammonia began at about £10, and improved to £12 10s. as the year advanced; the avoidance by the large makers of stocking the product keeping the market healthy. Values receded to £11 at the close of the year. It would be a curious question how much of this incessant movement is referable to the operations of the Sulphate of Ammonia Committee; but to ask it would be as idle as to inquire how much business accrues to a commercial firm from a particular advertisement. The Committee did good work obtaining, by the handsome offer of a 500-guinea prize, a masterly statement of the advantages of sulphate of ammonia in agriculture from Professor James Muir, which will stand as the classic monograph upon the subject. They also assisted, through Mr. John Hunter, in further elucidating the conditions of the profitable application of sulphate as a fertilizer for home-grown crops.

No substantial progress was made, for several reasons, in the interesting attempt to place cyanide recovery among the standard gas-works residuals processes. One obstacle in the way of this movement is the peculiar character of the only market for cyanide in large quantity. Another is the fact that only in the very largest gas-works is the process worth the doing; and even there it does not show very much profit. But the gravest trouble of the cyanide makers and dealers has been the check on gold mining in South Africa, where the chemical is ordinarily in demand for dissolving gold out of low-grade gravels and stamp-mill "slimes." Like everything else used in gold mining in these disturbed regions, cyanide is a "drug" for the present. There was no sound of any remarkable advance of chemical science likely to bring gas-works residuals into greater demand. It was asserted once more that coal-tar indigo was ready to replace the dyestuff obtained from the indigo plant; but experience does not warrant the producers of tar in expecting any pecuniary benefit from these much talked-of triumphs of organic chemistry.

The general dearness of all kinds of gas-works supplies, and the difficulty of procuring a sufficiency of the necessaries of the industry, placed prudent gas managers under compulsion to buy as little machinery and ironwork as possible. This is the more to be regretted, inasmuch as the introduction of machine work for all departments of gas manufacture is making headway faster every day. The printed "Proceedings" of the technical societies, and we may fairly say the advertisement columns of the "JOURNAL," show how important a part machinery and mechanical engineering now play in the equipment of all modern gas-works.

The gas supply of the Metropolis has been very much before the public during the year. Popular discontent with the disparity of gas prices in different parts of London was propitiated by the appointment of a Parliamentary Committee to inquire into the powers of charge of the London Gas Companies, and the manner in which these powers had been exercised. The inquiry was protracted and exhaustive, and resulted in the unanimous agreement of the Committee upon certain recommendations pointing to a revision of the sliding-scale in the case of the three Companies, and a partial re-arrangement of the districts of supply in order that the Gaslight and Coke Company might be relieved of their transpontine area. Notice has been given, both by the London County Council and the South Metropolitan Gas Company, of Bills for next session to give effect to some of the recommendations. Meanwhile, the Gaslight and Coke Company promoted a Bill to increase their capital powers upon the old footing in respect of standard price and sliding-scale; and it was thrown out by the House of Lords, after passing through the Commons. It is now being reintroduced. If these three London Gas Bills are referred to the same Committee, to be dealt with as parts of a whole, the proceedings would promise to be of exceptional interest and importance.

The actual gas legislation of the year was distinctly portentous. For the first time a standard price for the sliding-scale was revised, in the case of the Ilford Gas Company. A proposal of the District Council to acquire the undertaking compulsorily was rejected. It is true that in this Ilford precedent the proprietors did not actually suffer any cutting down of dividend; the standard being merely trimmed by shearing off an unused margin. But the Lords' Committee who performed the operation made it clear that they had no respect for excess dividends rendered possible by an unreasonably high standard price. In the Bristol Gas Act, some useful provisions were inserted, empowering the undertakers to regulate consumers' internal fittings more thoroughly than has heretofore been permitted. In the case of Loughborough, a strong precedent was created for the compulsory municipalization of a well-conducted gas undertaking, on a fitting opportunity, at the simple desire of the Local Authority. An alarm having been raised in Parliament in regard to the alleged monopolistic tendency of statutory undertakings, it

became the rule to forbid Gas Companies and Committees of Corporations to "manufacture" the accessories of the service which they wished to sell or hire out.

This consideration leads to the subject of the progress of Municipalism, which attracted much notice in Parliament and elsewhere. Sir John Lubbock drew attention, in his place in the House, to the growing propensity of Local Authorities to embark in trading ventures, to the detriment of their independence as guardians and regulators of the affairs of government. The Associated Municipalities themselves advertised the nature of their aspirations in this direction, by endeavouring to make good a claim to the absolute monopoly of any supply, such as that of electricity, undertaken with funds provided out of the rates. Meanwhile, much sharp criticism was directed upon the methods of municipal finance, in connection with the inadequate "depreciation" of the plant of municipal undertakings. It was charged that ratepayers are frequently hoodwinked as to the character of the returns from these enterprises. The necessity of a proper audit of large and complicated accounts was unhappily illustrated by a deplorable scandal in the commercial world. Attention was also directed to the rapid growth of the local indebtedness of the United Kingdom.

Generally speaking, notwithstanding the rapidly rising markets for supplies of raw materials and plant, the tendency of gas prices was downward. In London, the South Metropolitan Company brought their price down to 2s. 1d. per 1000 cubic feet; and the Gaslight and Coke Company announced their intention of reducing their price by 1d. per 1000 cubic feet—making it 2s. 11d. per 1000 cubic feet—as from the beginning of the New Year. The Liverpool United Gaslight Company, not working under the sliding-scale, brought down their price to 2s. 8d. The palm for cheapest gas goes to the Corporation of Widnes, where it is sold at the low figure of 1s. 4d. per 1000 cubic feet. The perennial difficulty of large discounts cropped up at Belfast. The proposal to further cheapen gas supply by establishing a connection between standard price and illuminating power, was put into the Bill of the South Metropolitan Gas Company already mentioned. Lights upon the working of other than British gas supply systems were given by the experience of the Imperial Continental Gas Association, who were driven out of Central Vienna, and by the declaration of a ruinous "war of rates" between the Gas Companies of New York.

Litigation over gas matters was active. The law of ownership of the subsoil of streets was further elucidated in the case of the *Vestry of St. Mary, Battersea, v. The County of London and Brush Provincial Electric Lighting Company, Limited*. The immunity of hired gas-fittings from distraint for rent was upheld in *The London, Chatham, and Dover Railway Company v. Cable*. The presumption of Local Authorities to prescribe to a Gas Company where they should lay their mains, was checked by a Board of Trade Order. A specimen of the troublesome kind of litigation known as river pollution cases, vexed the Bath Gas Company. A point of the law of "cutting off" was raised in *Griffiths and Another v. The Ilford Gaslight and Coke Company*. Another question in the same connection was finally answered by the House of Lords in the appeal case of the *Montreal Gas Company v. Cadieux*. Conflicts of statutory privilege and the general law were fought out in the Hull gasholder case, and in actions brought against the Wandsworth and Putney Gas Company and the Crowborough District Water Company. An unusual kind of action—a complaint of libelling a Gas Company—failed to gain the sympathies of Mr. Justice Day and a Special Jury. The uncommon spectacle of two Gas Companies fighting over a boundary dispute was exhibited at Bromley. The most generally interesting cases of the year, however, were those concerned with the administration of the Workmen's Compensation Act, which completed its first year of operation before the last Long Vacation. As was to have been expected while a totally novel enactment of this magnitude was in the interpretation stage many puzzling questions arose as to the scope of the Act and the basis of computation for compensation. Notwithstanding all that has been advanced to the contrary by persons antagonistic to the Act or to its framers, or both, its working has proved remarkably smooth where a little goodwill has been available as a lubricant. A heavy blow at picketing—ever the main support of strikes "to order"—was delivered in *Lyons v. Wilkins*, where the Appeal Court held that watching and besetting premises is illegal. The legality of relieving "strikers" out of the rates was questioned, but has not been finally settled.

Of patent litigation, besides the ever-simmering Welsbach proceedings, there has been little. An appeal to the Privy Council for the prolongation of the Coze master patent for inclined gas-retort settings failed. The original Welsbach patent of 1885 for the manufacture of an "illuminant appliance for use with gas-burners" lapsed by effluxion of time. Still the flood of incandescent litigation has flowed without intermission. No very striking points, either of law or technique, have come out of this year's Welsbach law, with the exception of the judgment just given by the Appeal Court in the "Daylight" case. Those who have followed the development of incandescent "mantle" making know that cerium has played in this art something like the part of the mysterious chemical referred to in the moving tale of Dr. Jekyll and Mr. Hyde. Welsbach thought, in 1885, that a little cerium would do the mantle no harm, and he said so. It was subsequently discovered that all the merit lay in the presence of a little cerium, with which even a mantle of zirconia—which Welsbach did not seek to monopolize—could be made to answer the purpose. The Court has held that Welsbach's warning against the use of too much cerium did not give him the pre-emption of employing a little of it of set purpose. He might have made his patent claim broader; but, as a matter of fact, he did not make it co-extensive with his discovery. All the difficulty of the case arose, in the judgment of the Master of the Rolls, from the tendency to confuse discovery and a particular invention. There is no safe and general rule for making the distinction; but the Courts will do it in particular cases, of course, at a price.

Of new discoveries or inventions in the wide field of the gas industry, the past year does not supply a single example of magnitude. But this is the old story. Important developments in the Arts and Sciences have a way of slipping into being without ruffling the surface of the great current of routine. It is only at some later stage that the stream is perceived to be bearing with it something which it had not a little higher up. Incandescent lights, of sorts, have been in evidence; and Mr. Sugg and Mr. James Keith have succeeded in different ways in solving the problem of high-power gas lighting by assisted combustion.

A glance through the "Register of Patents" in the "JOURNAL" any week will show the contemporary tendency of invention, which is not to be confounded with discovery. Incandescent burners and mantles, anti-vibrators, self-lighters—these are the limited gamut on which followers of Welsbach seem never tired of playing their proprietary variations. Another very great attraction for inventors is acetylene, which has come into greater use during the year for isolated lighting installations. Two congresses have usefully registered the technics of automatic gas lighting and acetylene. It is worth mentioning that pure science has lagged far behind practice in regard to incandescent gas lighting; there being as yet no rational hypothesis of the action of the active substance in this method of converting heat into light. In gas engineering, there has been no salient new departure. An increased sense of the gravity of the naphthalene nuisance in gas supply has caused gas managers to study the matter seriously, and take considered steps for curing or mitigating it. Messrs. R. W. Allen and W. Young have told the gas industry how much naphthalene common coal gas may be expected to contain; and Mr. Botley, Mr. Leather, and others, have described different means of rendering it harmless. Several adept experimenters have worked at the problem of the cheap and effectual carburetting of gas. Fuller information respecting the merits of the Dellwik water-gas process has been made available by Dr. Wimmer and Professor Lunge. A good word has been spoken by French gas engineering authorities for a corrugated coal-gas retort, the invention of Messrs. Teissier and Nègre. An interesting variant upon coal-gas manufacturing practice has been realized in the vicinity of Boston (Mass.), where coke-oven plant has been adapted to the production of illuminating gas for distribution. Sloping gas-retorts have held their own in many gas managers' favour; but it cannot be said as yet that the economic superiority of this system of carbonizing coal has been incontestably established for all cases. For coal-gas making on the very largest scale, where the machines can be worked to their utmost capacity, it is still claimed

that mechanically-stoked horizontal gas-retorts can beat any style of "slopers."

The extended use of carburetted water gas as an auxiliary means of production in British gas-works, is to be seen in all parts of the country. It is impossible to mention this modern innovation without referring to the agitation connected with it which led to the appointment in 1898 of a Home Office Committee to inquire into the manufacture and distribution of gas "containing a large "proportion of carbonic oxide." The report of the Committee appeared in February, and was immediately stigmatized, not to say laughed at, as a "medical scare." Some cases of gas poisoning occurred in several towns during the year; but not in rational proportion to the spread of carburetted water-gas distribution. There were some deplorable fatalities in gas-works. At Honley, in July, a gasholder under repair exploded, and caused the death of four men on the spot. An explosion at a neighbouring chlorate of potash factory wrecked a gasholder at St. Helens. The saddest catastrophe of the kind, however, occurred at the Rochdale Road works of the Manchester Corporation, when Mr. George Ernest Stevenson, Chief Engineer to the Gas Committee, and ex-President of the Institution of Gas Engineers, was killed under circumstances too notorious to need description. The fashion of acetylene lighting gave rise to several disastrous explosions of this dangerous illuminant.

The cause of Labour engrossed a good deal of attention from gas managers and other large employers. The advent of good times for trade and manufacturing industry brought higher wages for most classes of workers. Gas workers' wages ruled high; but trouble, invariably traceable to militant Trade Unionism, occurred sporadically in several gas-works. The most serious instance was that of Glasgow, where the Union attempted to secure "recognition" by the plausible-looking agency of a "Joint Conciliation "Board." The attempt was defeated. It is noteworthy that the men who revolted had no complaint to make against the terms of their employment. Likewise at Halifax, the Union interfered between the Corporation Gas Committee and their men, with the result that the Committee weakly consented to treat with a Trade Union official from Middlesbrough. Of course, anything the Committee may henceforth think fit to do for their men will be put to the credit of this individual and the Union. Better terms have been granted to the Leeds gas workers. In some towns, which shall be nameless, Labour politics have influenced the administration of the gas-works, and certain corporation officers have been held up to popular opprobrium for doing their duty. There was a ridiculous strike of gas workers in Paris, which only lasted a few hours. A hopeless attempt was made, in the name of the discredited Seamen's and Firemen's Union, to bring off a general strike of seafaring workers in British ports. Considerable advances were given to the wages of colliers. There was unrest in the building trades; and the Plasterers became "impossible." The Annual Trade Union Congress was made a *fiasco* by the exclusion of the Amalgamated Society of Engineers for a Society offence, which was nothing more than an act of defiance of the petty tyranny of another Trade Union. Meanwhile, attempts were made, and suggestions offered, for improving the lot of the industrial population. Having associated their profit-sharing workpeople in the administration of the undertaking, the South Metropolitan Directors proceeded to divest the scheme of some of the weakness of profit-sharing arrangements in general. The possibility of making State provision for the support of the aged deserving poor was further inquired into. An Act was passed to facilitate the purchase by workpeople of their dwelling-houses. The problem of the better housing of the working population ripened; and the success of the Workmen's Compensation Act was held to augur its further extension in the near future. An important strike in Denmark, and labour troubles in France, served as reminders of the fact that England has no monopoly of these outbreaks.

The technical organizations connected with the gas engineering profession have fairly justified their existence in the past year. The Gas Institute held a most successful meeting at the Westminster Town Hall, under the presidency of Mr. Samuel Stewart, of Greenock, which resulted in a large addition to the technology of gas manufacture. The occasion was distinguished, also, for two incidental features of the happiest augury. The Council succeeded in checking the mischief of excessive commercialism, which has for years overshadowed the organization and jeopardized its reputation; and the now historic personal feud which precipitated the disruption of the organized profession was publicly healed on the platform. The Institution of Gas Engineers passed through a varied experience. Their performance at the so-called business meeting during May was weak; and the character of the organization was only redeemed later by the triumphant Continental pilgrimage arranged by the President (Mr. F. D. Marshall) for the autumn fixture. It was felt, by the latter part of the year, that the continued separate existence of these national technical societies was no longer defensible; and advances were made from both sides, which, there is good reason to hope, will result in a reunion before the end of the century. The District Associations survived the year with more or less of credit; but some of them suffered noticeably from a lack of controversial matter suitable for expression in "papers."

Outside the meetings of technical societies, however, there has been very much for followers of the gas industry to think and talk about. Apart from subjects with narrow professional bearings, there have been discussions about technical and secondary education, the teaching of trades by apprenticeship or otherwise, the coming-on of mechanical road traction, and the failure of gas power to meet the requirements of heavy tramway working. The troubles of electric light undertakings have been both numerous and acute. The grave scandal of joint-stock company swindling has cried aloud for repression. The canker of illicit commissions has been laid bare. The strange political aberration that has fathered the outcry against the British petroleum oil trade has waxed and waned. London has received a new charter of municipal life. The manufacture of large gas-engines has received a great impetus. What say we? Have not Edinburgh, Glasgow, and other important cities and towns found it necessary to arrange for new gas-works? Has not the smoke abatement movement been revived? So many and various are the topics of the hour, the week, the year, that have passed in procession through our pages, that it is impossible even to hint at the half of them. The times are full, indeed; and gas engineers can no more afford than other living members of the State, to sit in their corner and rivet their attention to the assiduous picking out of the plums from their own particular pie.

Many good men and true passed into peace during the year. Mr. Frank Livesey, worn out with work in the interests of the great concern of which he was the Engineer-in-Chief; Mr. G. E. Stevenson, a martyr to duty; Mr. W. W. Greenough, late of Boston; Mr. Henry Simon, of coke-oven fame; Herr Henry J. Drory; Mr. W. H. H. Broadberry; Sir Edward Frankland; Mr. William Hardie; Dr. George Glover; Mr. D. Bruce Peebles; and, almost at the close of the year, Mr. F. G. Burfield, who won golden opinions of his promise while Secretary of the Gas Institute. It has been proposed to raise a memorial to the late Mr. G. E. Stevenson; and a compassionate fund has been opened by the Midland Association for the benefit of the children of the late Mr. James Fryer.

There is much more that might be said on the events and thoughts of the Old Year; but there is a limit to the exercise, which, happily, the exigencies of space set for us well on the hither side of wearisomeness of the subject. We now turn our gaze and our thoughts to the year that is about to open—the closing one of the century which has seen the thoughts of men widened and the achievements of their hands increased beyond all past measure. Still, the hope of the world and its demand is "Light—"more light!" As Sir Michael Foster told the British Association at Dover in September, "light is the great "stimulus of life;" and it is no mean occupation to be engaged in the supply of the greatest of the needs of intellectual civilization. The gas industry of the United Kingdom and of the whole world is strong and flourishing; and it is probably destined to still greater things. "With us, indeed, the past points not to itself, but to the "future; the Golden Age is in front of us, not behind us; "that which we do know is a lamp whose brightest beams "are shed into the unknown before us, showing us how "much there is in front, and lighting up the way to reach "it." May the coming year bring peace abroad, prosperity at home, and progress in our common calling—the spreading of light upon the earth!

WATER AND SANITARY AFFAIRS.

The Principal Events of 1899.

THE year which is now fast drawing to a close promised at its opening to be a very memorable one in the history of the Metropolitan Water Supply. The Royal Commission, appointed in May, 1897, had had forty-two sittings; and it was thought that the inquiry could not be very much further prolonged, although the Companies' case had not been completed. Notwithstanding that the London Water Question was, in a measure, *sub judice*, the County Council had deposited Bills to enable them to carry out one section of their Welsh scheme, to purchase the Companies' undertakings, and to raise the necessary money. This was the position of affairs when the Commission resumed their sittings on the 16th of January. In the interval, they had appointed an assistant, in the person of Colonel Rathborne, to examine the different estimates which had been submitted to them, and obtain from the witnesses any explanations he might require in reference thereto. The Water Companies had not the slightest objection to the appointment; but one was soon raised by Mr. Balfour Browne on behalf of the County Council. The language used by the learned gentleman in doing so was generally taken to mean that the Council would have nothing to do with the Assistant-Commissioner; but he afterwards explained that he had been misunderstood, and that they would be glad to give any information which might be desired. After this little episode, the inquiry proceeded uninterruptedly. The bulk of the evidence submitted to the Commission after the resumption of their sittings was given by Chairmen and officials of the Companies; Sir Henry Knight, the Chairman of the Southwark and Vauxhall Company, bringing forward a suggestion that the London and Suburban Companies should be formed into a federation, so as to create a community of interest in the water supply of the entire area. But chemical evidence was furnished by Sir William Crookes, the late Sir Edward Frankland, Professor Dewar, and Mr. C. E. Groves—the last named on behalf of the Thames Conservancy, whose Chairman and Engineer (Sir F. Dixon-Hartland and Mr. C. J. More) were also examined, as well as Mr. G. Corble, the Clerk to the Lea Conservancy Board. A few more witnesses were called, and the evidence closed on the sixtieth day of the inquiry. Then followed speeches of Counsel; and the protracted investigation came to an end on the sixty-fourth day—the 23rd of March—when the Commission adjourned *sine die*. It was understood that the consideration of the terms of the report would not commence until after the Easter recess. The long-awaited document has not yet appeared.

Two days after the inquiry was resumed, the Commission issued an interim report dealing with a matter which was regarded as urgent. Consequent upon the trouble caused in the East-end by the curtailment of the supply of water by the East London Company, owing to the prolonged drought in the summer of last year, the President of the Local Government Board requested the Commissioners to deal first with the third question submitted to them—viz., the practicability of connecting the different systems of supply of the Companies. Without, however, waiting for the views of the Commission on this point, the Companies had themselves promoted a Bill to enable them to effect intercommunication. Three different schemes were laid before the Commissioners; the third (which was a portion of one of the others), specially designed for the relief of East London, having been partially carried out. The evidence adduced enabled them to affirm the practicability of connecting the distributing systems of the Companies; and they recommended that arrangements should be made as soon as possible whereby an auxiliary supply of not less than 20 million gallons of water per day should be available for the East London Company's district. The outcome of this report was the announcement in the Queen's Speech at the opening of Parliament on the 7th of February, of the intention of the Government to introduce a Bill "for providing a more "complete distribution of water supply in cases of "emergency;" and before the close of the sitting, the President of the Local Government Board (Mr. Chaplin) gave notice that he would introduce the Bill on an early day. He fulfilled his promise on the 20th.

So far, all had gone well. But trouble soon came. In the print of the Bill which first appeared, the capital to be raised under it was to be subject to the sinking-fund provisions now general in Acts relating to water supply. A few days afterwards, however, and prior to the second reading, an amended print was issued which contained a proviso exempting the capital from the operation of the fund. This brought up the County Council. The insertion of the proviso in question caused much discomfiture to Mr. Stuart, the representative of the Council in the House of Commons, who characterized the measure as "wrong in conception and faulty in several of its most "important details." The Bill was, nevertheless, referred to a Hybrid Committee, where it was, of course, opposed by the Council, *more suo*, as unnecessary. Moreover, they strongly objected to the money to be raised being exempt from the operation of the sinking fund. In the result, the Committee passed the Bill with only some immaterial amendments. When it came before the House for consideration, however, further opposition was offered. But Mr. Chaplin stoutly defended his measure. The House was on his side, and the Bill was reported without amendment. On the 18th of April, the Leader of the House (the Right Hon. A. J. Balfour) obtained precedence for the Bill on the ground of urgency. Mr. Stuart made an attempt to have the measure recommitted, so to have its "faults of "a serious character" further considered. He did not, however, press the matter, as there would be an opportunity in the Upper House of the "faults" in question being dealt with in Committee. The Bill was then read the third time and passed. In the House of Lords, it encountered further opposition in Committee; an amendment being proposed for meeting the views of the Hertfordshire County Council as to the abstraction of water from their district. This alteration was not accepted by the Committee, who eventually passed the Bill, subject, however, to the insertion of the objectionable sinking-fund clause. When the measure came before the House, there was contention over this matter—Lord Ribblesdale, the Chairman of the Committee, defending the clause, and Lord James of Hereford and Lord Salisbury speaking against it. Eventually it was struck out, and a proviso was put in that the sinking fund was not to apply to the capital raised under the Bill. A new clause was inserted prohibiting the construction of works for utilizing water drawn from wells outside the Companies' limits; and, as thus amended, the Bill went to the House for third reading. This stage was successfully passed on the 18th of May; and the Bill received the Royal Assent, as the Metropolis Water Act, 1899, on the 6th of June.

It will be convenient now to record briefly the progress of the Bills promoted by the London County Council. The two relating to the Welsh scheme—the Reservoirs and Works Bill and the Aqueducts and Works Bill—failed to comply with Standing Orders. In the former case, the non-compliance complained of was in respect to giving notice to parties; in the latter, no plans were deposited. The Standing Orders Committee decided to dispense with compliance in the case of the petition for the Reservoirs Bill, and allow the Bill to proceed. It did not, however, make much progress, for when it came before the House for second reading, on the 21st of March, Mr. Whitmore pointed out that it would be inexpedient to let it pass that stage before the Royal Commission had presented their report; and the House agreed with him. The Bill remained in the paper for some weeks, and was eventually withdrawn. The Aqueducts and Works Bill never appeared in the paper. The Finance Bill was withdrawn on the 27th of April; and the Purchase Bill, after several postponements of the second reading at the solicitation of Mr. Stuart, was withdrawn on the 1st of June—a judicious proceeding which relieved Mr. Whitmore of the duty he had taken on himself to move the rejection of the measure.

Four out of the eight Bills affecting the Metropolitan Water Supply which were promoted last session were thus disposed of. As to the rest, the Companies withdrew their Intercommunication Bill, in view of the action of the Government; as did also Mr. Harry Samuel one brought in by him for a like purpose. The West Middlesex Company succeeded in passing their Bill to sanction the laying of a 42-inch main from Hampton to Barnes and the raising of further capital, subject, however, to the sinking-fund clause. Two Bills promoted by the East London Water Company to enable them to obtain a further supply of water from the Thames, and construct additional reservoirs and other works, were consolidated, and successfully

passed the House of Commons Committee, presided over by Sir Joseph Pease, though the County Council struggled hard both in Committee and subsequently in the House, to get the "seven years" clause inserted. An incident which deserves mention in connection with the inquiry on this and the West Middlesex Bill, which were referred to the same Committee, was the receipt by the Chairman of communications from the Local Government Board with regard to the Committee giving their sanction to Bills unless it was clearly shown that there was immediate necessity for the works contemplated in the interval between that time and the issue of the report of the Royal Commission. Sir Joseph Pease did not like this dictation; but, as he remarked, the Committee had not stood upon their dignity. Safe through the Commons, the Bill went to the Upper House, where the opposition was too strong for it, and it was thrown out by Lord Brougham's Committee. The Company submitted with dignity to their defeat; but the Chairman (Colonel Lockwood, M.P.) was careful, in a letter to the Local Government Board and the Press, to place upon the right shoulders the responsibility for any difficulty that might result therefrom.

In the general parliamentary work in connection with water supply, the Derwent Water Scheme stands out most conspicuously. Derby, Leicester, and Sheffield were all contending for the watershed of the Derwent to increase their supplies; and the merits of their claims were under the consideration of a Select Committee of the House of Commons, presided over by Sir John Brunner, whose sittings extended, with intervals, from the 26th of April till the 16th of June. The outcome of this long inquiry was the constitution of a Joint Board, composed of representatives of the Corporations of Derby, Leicester, Nottingham, and Sheffield, and the County Council of Derbyshire, to control the watershed, and carry out the necessary works. The proceedings in connection with this matter were necessarily costly; but the result has given general satisfaction. The Board has been formed, with Alderman Gainsford, of Sheffield, as Chairman. An important principle obtained recognition for the first time during the inquiry—viz., the right of County Councils to appear before Parliament with reference to water supply questions. Another significant item in the parliamentary programme was the Bill promoted by the Stockport Corporation to enable them to acquire the undertaking of the Stockport Water-Works Company. After passing the Commons, the Bill met with some rough treatment at the hands of Lord Camperdown in the Upper House. The promoters managed to get it through, but not quite in the form they desired, as the net profits are not to be applied in relief of the general rates, but in reduction of the water-rents. On the other hand, the Bill of the Southampton Corporation, by which they sought to acquire a portion of the undertaking of the South Hants Water Company, was kindly treated in the serene atmosphere of the Upper House, but received its *quietus* in the Commons. The Godalming Corporation were authorized to purchase the undertaking of the Frith Hill, Godalming, and Farncombe Water Company, against the wishes of a section of the shareholders. Purchase was also authorized at Clay Cross. The water legislation of the year included the incorporation of several Companies, the enlargement of works and extension of boundaries, and the raising of additional capital. A Bill promoted by Mr. Cornwallis, the member for Maidstone, to so amend the law respecting the supply of water as to prevent contamination, never passed beyond the first reading, and shared the fate of the "innocents" on the 25th of July.

No retrospect of the year now closing in would be complete without reference to the remarkable summer which characterized it, with its attendant long spell of dry weather. Writing in these chill December days, it almost imparts some warmth to reflect on that time of intense heat, when the heavens withheld from the parched earth the greatly-needed rain. The meteorological records showed that the drought affected practically the entire kingdom; but the Metropolis was the greatest sufferer. From the commencement of June till the end of August, the total rain measured at the London station of the Meteorological Office was only 1·9 inches, which was smaller than the average fall in any single summer month. When these figures are compared with 6·83 inches, the quantity of rain which usually falls in the summer three months, the severity of the drought will be readily appreciated. Fortunately, the supply of water had not to be curtailed at the East-end, thanks to the intercommunication arrangements the Companies were able to carry out. Several attempts were made to get up a "scare;" but they were ineffectual. Of course, the Thames was low; and the fact was promptly seized upon by the County Council, whose Water Committee stirred up the Local Government Board, with the view of getting from the Department some statement as to what steps they had taken to protect the Metropolis from want of water. Fortunately, there was no want; and the only restriction put upon the consumers was in the use of water for gardening purposes. The Metropolis was by no means singular in this respect, as a check had to be put upon this and other lavish methods of getting rid of water in some of the largest provincial towns. Birmingham, Bradford, Leeds, Lancaster, Manchester, the Midlands, and South Wales all suffered, more or less, from the long absence of rain. Relief came at length, at the end of August, when there was a fall which was pretty general throughout the country. The severity of the drought brought into prominence the question of waste; and public attention was called to the matter by a letter in "The Times," in the course of which the writer stated that "London throws away every day twice as "much water as would suffice for all the needs of Birming-"ham and the surrounding neighbourhood." He did good service by showing how all this could be saved without withdrawing a drop from any legitimate purpose, public or private, not excluding the watering of plants. In connection with the subject of waste, reference may be made to the correspondence on "The Consumption of "Water per Head in Different Towns" which recently appeared in our columns, and which is closed to-day by the letter of the "Distributing Engineer" whose article in the "JOURNAL" for the 8th of August gave rise to it.

Reference to the economical use of water by the consumers leads naturally to the question of its conservation on a large scale. The necessity for having some kind of control of watershed areas has engaged the serious attention of the British Association of Water-Works Engineers, who appointed a Committee to deal with the matter. They arrived at the conclusion that the entire water supply of the United Kingdom should be subject to the general control or supervision of some independent body or department, for reasons which they specified in their report presented at the meeting of the Association in June. These reasons have been freely distributed about the country. The matter has also been taken up by the County Councils Association, who have addressed a circular-letter to the Clerks of County Councils and other Local Authorities in England and Wales, pointing out the necessity of immediate steps being taken to protect the rights of localities in the natural water supplies existing within their areas. The trouble in this case is rather in regard to underground water, the law as to which is perhaps not so clearly understood generally as it might be; and therefore the masterly exposition of it given by Lord Robert Cecil a few weeks ago deserves mention here as a noteworthy feature in the year's history of water supply. While upon the subject of law, we may refer to two important decisions given during the year on the question of the rating of reservoirs—the works in question being those of the Liverpool Corporation and the Southwark and Vauxhall Water Company. In the first case, the point to be decided was whether the assessment to the poor-rate should include the estimate of the amounts expended in providing buildings in substitution of those cleared away in carrying out the works, or whether they should be omitted from the calculation. The Divisional Court said they should be left out; but the Appeal Court held that they should be included, on the ground that regard must be had to the total amount which the Corporation deemed it worth their while to spend. In the second case, the House of Lords upheld the principle that reservoirs are to be regarded as "land covered with "water," and be rated at one-fourth only of their net annual value. In a dispute between the Crowborough District Water Company and the Local Authority as to the deposit of plans and sections of a water-tower, it was decided that the Company's Special Act did not exempt them from compliance with the Authority's bye-laws in regard to buildings.

Allusion has been made to the British Association of Water-Works Engineers. At their fourth annual meeting, in June, in addition to the question of watershed areas

mentioned above, the subjects of auxiliary water supplies for towns, sand filtration, and the saline constituents of water obtained from the chalk were discussed with helpful results. After the business, the members were able to pay a visit to the works of the East London Water Company at Lea Bridge. Concurrently with this meeting came the second annual conference of the Institution of Civil Engineers, at which two papers of great interest to water engineers were read. In the first, it was shown that flood water, far from being worthless for potable purposes, may be utilized without restriction, provided it is subjected to subsidence and efficient filtration; while in the second, attention was usefully directed to the varying consumption of water per head per day in different towns, and the causes thereof were considered. This paper gave rise to the communication and the correspondence to which reference has been made in a previous paragraph. A visit to the Staines reservoirs, where opportunity was afforded of witnessing the great progress made with these works since their commencement in May last year, was by no means the least interesting and instructive of the visits arranged by the Council of the Institution. In addition to these meetings, those of the Manchester District Institution of Gas Engineers and the Institution of Mechanical Engineers, as well as the congresses of the Sanitary Institute and Royal Institute of Public Health, were productive of papers dealing with technical and general subjects bearing upon water supply and sanitation. An interesting paper on the "London Water Supply" was read at the Society of Arts by Mr. Walter Hunter, M.Inst.C.E., the originator of the Staines Reservoirs Scheme; and another on the same subject, in conjunction with the Welsh Scheme of the London County Council, at the Sanitary Institute, by Mr. R. E. Middleton, M.Inst.C.E., who was associated with him in carrying out that work.

This glance at some of the principal events of the year must not close without reference to the removal by death of several men whose names were more or less associated with water and sanitary questions. First to call for notice is the loss of Sir Edward Frankland, the eminent Chemist, and the Water-Examiner to the Local Government Board, who died suddenly while on a holiday in Norway. A few months later, Major-General Scott, the Official Water Examiner under the Metropolis Water Act, 1871, was taken from us; another member of the Royal Commission—Mr. H. W. Cripps, Q.C.—having predeceased him by only a couple of months. Sir Douglas Galton, who died early in March, was a prominent member of the Sanitary Institute, and was identified with all movements having improved sanitation for their object. Sir Richard Thorne Thorne, the Chief Medical Officer of the Local Government Board, whose sudden death last week is recorded elsewhere, held a high place as a sanitarian. Two of the three offices thus rendered vacant have already been filled. In the appointment of Dr. Thorpe as successor to Sir Edward Frankland, the Local Government Board have selected a gentleman who has attained considerable distinction as a Chemist; while the Department have already had opportunities of judging of the qualifications of Mr. Charles Perrin to fill the position till recently occupied by Major-General Scott. In this connection, reference may be made to the recent discontinuance of the bacterioscopic examination of the water supplied to the Metropolis, the results of which were recorded so regularly in Sir Edward Frankland's monthly reports.

Glancing over the events of the past twelve months which have been here touched upon, it will be seen that they have not been of the momentous character which might have been expected. What those are likely to be which the New Year will bring forth, we need not now stop to consider.

Professor H. B. Dixon on the Explosion of Gases.—Last Thursday week Mr. Harold B. Dixon, Professor of Chemistry at Owen's College, Manchester, delivered a lecture on "The Explosion of Gases" in the Music Hall, Aberdeen. It was one of a series provided by the Corporation. Lord Provost Fleming, who presided, described Professor Dixon as the chief British authority on the question to be brought before them. He and other scientific men had been able to show that the apparently erratic and lawless phenomena of the explosion of gases were in reality subject to the most rigid laws. The lecture, which was necessarily largely of a popular nature, was highly interesting.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1589.)

FLAT as every department of the Stock Exchange was at the close of last week, they have found a deeper depth still since then; and prices have sunk to a level that they have not touched for many years. At times like these, it is highly important that the true causes of such phenomena should be ascertained and recorded; and it is especially so now when we are suffering from mental depression produced by military reverses. These have no doubt their influence in our Stock Markets; but the prime cause of the great fall in values is spread over a wider field than the field of battle, and is to be found in the condition of the Money Markets of the world. Wall Street has been in an extremely highly-strung state; the Bank of Germany has had to raise its rate to 7 per cent.; and, on Thursday (although the Bank of England Directors again abstained from an advance), the Bank of France was compelled to raise its rate by 1 per cent. At each successive monetary move, our Stock Markets, which had opened calm and steady, were knocked flatter and flatter. On Tuesday, Consols were done at 98; and compulsory sales in other lines brought prices down with a run. This cleared the atmosphere a little, and things were better next day; but the tightness of Thursday soon hurled them down again. It will be an anxious settlement; and everyone will be glad when we are through the year. In the Gas Market, business was quiet enough, and prices naturally were down; but not as much as might have been the case in such circumstances. Gaslight ordinary actually advanced a point. On Tuesday, a parcel was done "specially" as low as 102½; but on Thursday it changed hands at 105. The debenture, however, fell two points. South Metropolitan were quoted lower, but the actual figures realized were steady. Nothing was done in Commercials. In the Suburban and Provincial group, Brighton "A" receded. The Continentals felt the flatness—both Union and Imperial giving way. Among the rest, Oriental and River Plate were fractionally lower. Not much business was done in the Water Companies; but in view of the increased value of money, there was a general revision of prices—most issues being subjected to a reduction of from 1 to 3 per cent.

The daily operations were not of sufficient magnitude to call for detailed notice; and the numerous variations of quotation are noted in the share list.

ELECTRIC LIGHTING IN 1899.

A Retrospect.

IN writing the history of electric lighting and electrical engineering enterprises in general for the year, we shall without apology survey the record from our habitual standpoint of frank admiration of the science and equally candid scepticism of the commercial soundness of many of its applications. Nobody can deny the truth of the reference to electricity in the eloquent address of the President of the British Association: "If there be one word of science which is writ large on the life of the present time, it is the word 'electricity.' . . . The knowledge which it denotes has carried its practical results far and wide into our daily life, while the theoretical conceptions which it signifies pierce deep into the nature of things." The practical application of electricity to the production of artificial lights of useful form and power has settled into standard type embodiments which do not change from year to year. The past year has witnessed much progress in the electric lighting business, in respect of increase of public patronage. The number of lamp connections of the established supply undertakings in favourable situations has increased; and many new undertakings of the kind, chiefly owned by local authorities, have started. The enterprise consequently represents more capital, and employs more labour, than ever before. In the statutory regulation of this important and interesting industry, some modifications have been made, and others are sought by interested parties. Formal confirmation of the principle of limited competition in electricity supply was given by the admission of a second Electric Lighting Company into the City of London, hitherto the preserve of one Company. On the other hand, the principle which forbids competition by public funds with private enterprise was confirmed by the Marylebone Vestry being compelled to buy up the prior rights in the parish of the Metropolitan Electric Supply Company before starting a local undertaking of their own. The parliamentary procedure in regard to the obtaining of Electric Lighting Orders was simplified by the passing of a Clauses Act.

The attempt to establish electricity generating concerns for supplying current in bulk in the vicinity of convenient sources of power was represented by several Bills, none of which survived the test of the Committee stage. The reason for this failure was lack of proof of the engineering and commercial advantage of the schemes. A glowing account of the success of the Niagara Cataract water-power enterprise, by Professor George Forbes, was published; but it did not show that the success is of a kind that could be repeated in this country. The best customer of the Company is a manufacturer of calcium carbide—a product

which has no other use than as a rival of the electric light. Besides, there is no British Niagara; and the project of creating a large hydraulic power electricity works in Scotland was one of those which failed to justify itself in Parliament. The idea of electricity-in-bulk generation from the cheap waste fuel of the coal-fields is at the bottom of several fresh schemes of which Parliamentary Notices have been given for next session. Municipalism, however, is strongly against anything and everything of the kind which might compete with the statutory privileges of Local Authorities who supply electricity in their own districts. The Associated Municipalities are bent upon obtaining, as a corollary to the Electric Lighting Act, a parliamentary ruling that a Local Authority's electricity supply undertaking shall be a strict monopoly.

Meanwhile, the largest London Electric Lighting Companies are proving the wisdom of the long-accomplished removal of the Metropolitan Gas-Works to the outlying manufacturing fringe of the town. They have learnt that it was a costly mistake to plant their generating stations in the middle of the district of supply, and that the idea conveyed in the term "central station lighting" is something that should be changed for a better. Painful experience taught them that they must not shake houses near the stations; and this year they have begun to learn that they must not pollute the atmosphere with their smoke. A lively revival of the crusade against the smoky factory chimneys, under the leadership of Sir W. B. Richmond, R.A., arose directly in respect of the working of a Hammersmith electric lighting factory. The cumulative penalties of the law have begun for most of the London electric lighting stations; and it is only a question of time for the weight of the punishment to become heavier than they can bear. In these circumstances, the owners of some of these stations are either nerving themselves to abandon them, or are actually supplanting them by larger factories in the outskirts. Before long, an intra-mural electric lighting station will be as legendary as a city gas-works.

Unfortunately for the electricity supply business and its patrons, growth of the supply in mere bulk does not bring with it greater reliability in action. Electricity can no more be stored than the force of a hammer-blow; and consequently the largest supply stations suffer the most far-reaching breakdowns. Moreover, for one reason and another, some of the biggest electric lighting undertakings in the kingdom have this winter disappointed their customers. The supply has been short, just at the "peak of the load" for the day—that is to say, at lighting-up time and for a couple of hours after; and this shortage, in combination with disastrous breakdowns of generating and distributing plant, has been the salient feature of the present winter season in this connection.

With respect to the profit of an electric lighting business, there is little that is favourable to be said. With exceptions that could be counted on the fingers of both hands, no electric lighting undertaking, public or private, is really solvent as actually carried on. An excessive, and always open capital account, and inadequate allowance for depreciation of plant and mains, are the curses of electric lighting finance. This is not our judgment, but that of our financial contemporary, the "Statist," whose impartiality is unquestioned. It began to be felt that the Local Government Board and the Board of Trade should no longer grant Electric Lighting Orders, and sanction electric lighting loans, for small Local Authorities who cannot hope to carry on the business at a profit, or even to make both ends meet. Hitherto it has been hopeless for Gas Companies, acting as ratepayers, to oppose Local Authorities' aspirations in this respect; but this year it has been our pleasure to record that the words of truth and soberness, albeit originating with a Gas Company, have prevailed with the authorities of Whitehall, and stopped municipal extravagance. Penzance and Ramsgate have given a timely hint to head-quarters, by proposing to capitalize the loss of the first few years of Corporation electric lighting, so as to prevent it from becoming a burden to the ratepayers. The London County Council have taken a strong lead, and made it a rule that the depreciation of Municipal electric light plant shall be provided out of revenue, altogether above and beyond the payments into the sinking fund for redeeming original outlay.

There has been no material improvement in the means and appliances of electric lighting. Although the construction of arc lamps shows some advance in the direction of greater convenience of management and steadiness of effect, they cost as much as ever; and the small arc lamps, so long desiderated, are still to seek. On the other hand, very large and powerful incandescent electric lamps have come into use for display work; but they are very expensive. The general raising of the voltage of supply currents has necessitated the corresponding use of high-voltage lamps; and these are now commonly observable with two filaments instead of one. They are certainly not more economical of current than the older pattern, and do not last so long. A great *furore* was created over a new make of incandescent electric lamp, by Professor Nernst, in which the carbon filament enclosed in a vacuum bulb was replaced by an exposed rod, which, however, required to be heated by extraneous means before it would conduct electricity and give a light. This invention still hangs fire. Absolutely nothing has been done in the way of lighting by induction effects, on the Tesla system; and the direct conversion of carbon into electricity has receded into the background.

The electrical novelty of the year was the achievement of Marconi in transmitting signals through space without wire connection. In the field of mechanical tramway working, the overhead "trolley-wire" system of electric car-driving came more and more into use in the United Kingdom, for want of a better. Dr. A. W. B. Kennedy was entrusted with the task of adapting electricity somehow to the working of the tramways under the control of the London County Council. Steady progress was made with the construction of deep-level tunnels for relieving by electric light railways the congested Metropolitan street traffic. Experiments were pushed on with respect to the possible conversion of the Metropolitan and Metropolitan District Railways to electric instead of steam locomotion; but the only intelligence that leaked out in regard to these experiments was not of an encouraging cast.

The application of electric power distribution in factories and to the working of machine tools went on spasmodically. It was difficult amid the clash of opposing interests to see exactly where the advantage lay in this movement. A good deal of parade was made of American and Continental practice in this respect; but it usually turned out that the people who claimed to make most use of electric power were those who had electric motors to sell. Still, in cases where it was desired to take the tool to the work, instead of bringing the work to the tool, electric driving seemed to possess peculiar handiness. Beyond this, there is but little to tell. The cable makers seem to get the most of the money in the electrical business in every department. Next come the boiler makers, the builders of engines and dynamos, and the lamp makers. The consulting electricians used to have a good "look in;" but their day is past. The men who do most of the work now are the under-paid central station engineers, who have to make the best of the big-wigs' mistakes—and what blunders they were!—and pick up everybody's loose-ends. It is these worthy and devoted engineers, mostly young, who have to "stand the racket" after the first year or two of smooth central station working when the excessive plant laid down under the supervision—usually telescopic—of the gentleman from Great George Street was gaily "taking in the slack" of the prospective load. Then, when at length the plant begins to feel its full load, with all the consequences of this condition of working, who but the resident engineer is held responsible for everything that the retired consultant and his contractors did or failed to do? It is no wonder that many an electric light engineer throughout the country is hoping for a tramway extension which shall be big enough to cover the multitude of sins of the early electric lighting pretenders that must otherwise come to judgment.

The Kent Coal-Boring Operations.—We learn from the "Financial News" that another coal-seam, measuring 13 inches thick, was struck at Dover on the 16th inst. This makes the fourth seam discovered there. It is said the coal is of good quality; and it was found with 2 ft. 8 in. of excellent fire-clay.

Transactions of the Gas Institute.—We have received the volume of "Transactions" of the Gas Institute for the present year. It consists of the report of the proceedings at the thirty-sixth annual meeting, held in London last June, with the usual supplementary matter, comprising the lists of members, &c., and the subject-index brought up to date. It has been produced under the editorship of the Secretary, Mr. Walter T. Dunn.

Continuous Process for the Production of Calcium Carbide.—It is reported that a process by which calcium carbide can be continuously produced more cheaply than by that at present in use has been discovered by Professor Freeman, who has been conducting a series of experiments at the Armour Institute, Chicago. A huge arc lamp enclosed in brickwork in the interior of a furnace was employed. The upper electrode of the lamp was hollow, and through it was fed a powder composed of 60 per cent. of common lime and 40 per cent. of coke. This powder, being carried through the upper carbon directly into the electric flame, was melted by the intense heat. All the power of the electric plant of the Institute was turned into the electrodes; and calcium carbide in a molten state ran from the machine. It was estimated that the carbide was produced at a cost of ½ c. per pound. According to Professor Freeman, the great gain indicated was due to the continuous production of carbide.

Ten Years' Working of the South Metropolitan Gas Company's Profit-Sharing Scheme.—We have received a very tastefully designed Christmas card which the Directors of the South Metropolitan Gas Company distributed to their employees last week. In addition to the usual seasonable good wishes, it presented to the men a few facts and figures contrasting their position in 1889 and now. The former was the year of the strike; and against this date the Directors record their remembrance not only of its troubles and losses, but of its "great gains and the willing service of the loyal and new men" at that trying period in the Company's history. In 1899, there is "continuous mutual confidence, goodwill, and peace between employers and employed." The result of the changed conditions is that, as the outcome of the introduction of the profit-sharing system, the employees have the substantial interest in the Company shown by the following figures: The 2890 profit sharers now hold £66,710 of stock, having a market value of £92,393 7s. They have also on deposit, at interest, £29,772 10s.; making a grand total of £122,165 17s. These striking figures may be left to point their own moral.

EMPLOYERS AND THE WAR.

THE steps that have already been taken by the Government, in face of the serious situation in South Africa, involve a considerable amount of inconvenience for, and demand no little pecuniary sacrifice from, employers of labour in this country. It is unnecessary to say that such inconvenience and sacrifice will, in the circumstances, be willingly and cheerfully borne. The demonstration of substantial patriotism evoked by the calls made upon the nation by the Government is sufficient evidence of the spirit in which the necessities of such a situation as the present will always be met by all classes of the community. We remarked last week that the calling out of the Reserves and the Militia—numbering between them some 200,000 men, almost all engaged in productive industry—would have no inconsiderable effect upon the supply and remuneration of labour, in addition to which, of course, the employers of a great number of these men are contributing to the maintenance of those they leave behind them. The call now made for some 22,000 Volunteers (8000 Yeomanry, 7000 Infantry for active service, and 7000 more to constitute a Home Reserve) will deprive employers of the services of some of their professional and clerical servants. In this respect the gas industry will probably bear its share of the inconvenience. There are, doubtless, many Volunteers on the staff of the Gas Companies throughout the kingdom; in particular, we believe, the Gaslight and Coke Company have an especial interest in the 22nd Middlesex, of which the late Mr. John Orwell Phillips was Honorary Colonel, and the Chief Engineer at Beckton is at present a Captain. Although only about 5 per cent. of the Volunteer force are asked for, yet, since almost every man will come forward, it is impossible to say who will be taken and who left. In view of the generous manner in which the many Gas and Water Companies affected have acted in regard to those of their employees who have rejoined the Colours as Reservists, we need scarcely express the hope that, where cases arise, they will, in the same spirit, make it possible for Volunteers upon their staff to offer their services to their country abroad without thereby forfeiting their positions or their prospects. This can, indeed, be made practicable to employers by the fellow-servants of such Volunteers taking upon themselves the task of performing the duties of those desirous of tendering their services to the authorities. If, in addition, the employers will guarantee the maintenance of any dependents otherwise unprovided for, everything that the civilian community can do to facilitate the Government's plans will have been done. We, indeed, hear already that some of the leading London firms are granting leave of absence with full pay to the Volunteers in their employment. Were it not for the terrible price it is costing, we might rejoice that the opportunity should have arisen for such a manifestation of the fact that the old best spirit of England's fighting days endures in these milder times: The soldier keen for his duty, the civilian eager for his; party and class forgotten in one common object—the honour of the race.

WAGES AND PRICES IN THE IRON AND STEEL TRADES.

THERE have just been issued by the Board of Trade some statistics which show very plainly the flourishing condition of the iron and steel industries—a condition which has had a very material effect upon the gas world, not only directly, by increasing the cost of goods used in the construction of works and of plant and machinery generally, but also by its reaction upon the coal market. The present scarcity and dearness of coal is—as has been previously pointed out in the "JOURNAL"—very largely due to the great activity in the iron and steel trades, to which it is a vital necessity. The primary causes of the activity are probably numerous, and undoubtedly obscure; but, one of the certain sources of the revival has been the birth of new, coupled with and inducing the rapid growth of the old, navies. Japan, awaked from her sleep of centuries, has suddenly changed from the chrysalis to the dragon fly; America even more recently has stepped forward to take up "the white man's burden;" we have been and are turning out battleships and every other form of floating armament as fast as the yards can build them; and in a greater or less degree every other naval power (except Italy) has been adding to its strength. Finally, the German people are being asked to double their navy in something less than twenty years, a proposal which, if adopted, will have the inevitable effect of inducing Great Britain to go not one but many better, and of urging the other naval powers to increased exertions.

Whatever the cause, the effect is manifest and striking. The Board of Trade figures show that pig iron has reached in 1899 a higher average price per ton than during any year in the past decade. The price of Cleveland pig iron, which drooped from £2 7s. 8d. per ton in 1890, to £1 15s. 3d. in 1895, has averaged £2 9s. 4d. for the first three quarters of this year; while Cumberland pig iron has risen from £2 4s. 3d. in 1894 to an average of £3 6s. 3d. for the nine months ended September last. There can be no doubt that the final average for the year will in both cases be even higher; for prices have risen decidedly during the current quarter.

As in the majority of cases the wages of the workers depend upon the selling price of the iron and steel, it is but a natural consequence that the increase in the earnings of the workpeople has been continuous and great. The figures given are practically final for the year, as no further changes will be made under the sliding-scales. The net result of the year's working is that some 76,000 employees have received increases amounting to 3s. 3½d. per week for each individual. This is far and away the most striking and substantial rise that these workers have enjoyed during the seven years in which the Board of Trade have kept their records. The first three years showed a reduction; and the second three did little more than restore wages to their previous level. Blast furnace-men's earnings have risen during 1899 not less than 20 per cent.; and other workers about 12½ per cent. This large increase in the earnings of the ironworkers, together with the considerable rise in coal-miners' wages, have had the natural result of raising the standard of wages in most other industries.

The causes we have specified as accounting for much of this remarkable revival of the iron trade, do not lead one to think that any considerable reaction is to be looked for in the immediate future. It is none the less surely inevitable; and the only thing for gas companies to do is to await that reaction with what patience they may, and, in the meanwhile, so far as possible, to "lay low an' *buy* nuffin.'"

PAUPERISM AND OLD-AGE PENSIONS.

WE last week called attention to contributions to the discussion on the provision for the aged deserving poor made at the recent Poor-Law Conference by Sir Robert Giffen, and others possessing practical knowledge of the subject of pauper relief; and we emphasized the necessity in such matters of considering facts and possibilities, rather than blindly following the dictates of unsubstantial sentiment. We must not, we would observe, be misunderstood as decrying the value of sentiment in either social or political life. Rightly controlled, sentiment is the salt of the earth; but when allowed to run riot, and to inspire action in direct violation of reason and experience, it is a potent factor for evil. That is the ground upon which we base our advice and our desire to examine every proposal which makes its strongest appeal to sentiment, by as much of the dry light of ascertained facts as can be obtained. It is, we know, neither the easiest nor the most popular method of approaching social and economic problems. But it is the only safe and rational way; and there is, after all, no obvious reason why a tender heart should be the exclusive possession of a soft head.

The annual report of the Local Government Board is a mine of information bearing upon the question of the aged poor; the section in which the bulk of this information is embodied being that containing the reports of the General Inspectors of the Board with regard to the condition of pauperism and the administration of poor relief in their districts. These reports for 1898-9 certainly bear out Sir Robert Giffen's optimistic conclusions as to the reduction of pauperism in this country. In proportion to population, the diminution has been remarkable, being now exactly one-half what it was 36 years ago; while comparing the mean number of paupers of all classes in England and Wales for the year ended at Lady-day 1899 with the corresponding period 50 years ago, the figures are even more striking. In the year 1848-9, there were 1,088,659 paupers, equal to 6·27 per cent. of the population; and in 1898 9, only 831,938, or 2·65 per cent. of the population. In glancing down the percentages for the half century, one very satisfactory truth stands out clearly, and that is the rapid fall in the percentage of pauperism that followed the establishment of a national system of education. The figure for 1872 was the same as for 1860; it is now little more than half that percentage.

In the individual reports of the Inspectors, there is much of interest and worthy of note. Mr. H. Lockwood, Inspector for the district comprising the Metropolis, calls attention to the increasing number of indoor paupers, though the total of indoor and outdoor together remains almost stationary. During the first week of 1899, the "in" paupers were higher than in any year during the past decade; while the "out" paupers reached the lowest figure for that period. The three main reasons suggested for this transfer from outdoor to indoor are: "(1) The superior accommodation, medical attendance, and nursing now provided in the poor-law infirmaries; (2) the more eligible conditions of life in late years in the workhouses; and (3) the operation of Trade Unionism and Employers' Liability, which [continues the report] have a tendency to remove from the labour market all but the most efficient workers. To what extent the two latter are responsible for the increase, is a question as to which it would be rash to offer any very decided opinion. But it is generally admitted that of late years there has been observed an increasing number of workhouse inmates who, though perhaps incapable of earning a full wage, could not reasonably be classed as infirm through age or other cause; and it is possible that the comforts and indulgencies now generally afforded to the indoor poor may, in some cases at least, offer inducements to remain chargeable, rather than to make renewed effort to earn an independent living." We think the extent to which recent legislation respecting employers' liability has resulted in the discharge of, or refusal to employ, elderly men has been

much over-estimated, and will diminish rather than increase in the future, as the alarmist view at first taken by some employers of the Workmen's Compensation Act is shown by experience to have been unfounded. The third reason given strikingly illustrates the great difficulty of administering the Poor Law so as to satisfy humane sentiment without injury to the community. It points strongly to the necessity for the separate treatment of the old and deserving poor. It is the natural repugnance of the community to allowing such among the paupers to pass their last days in the cheerless and forbidding atmosphere of the workhouse, as usually depicted, that has so greatly stimulated the cry for an old-age pension scheme. It is obvious from Mr. Lockwood's report that any considerable mitigation of the rigours of workhouse life, if general to all classes of pauper, has a distinctly unsatisfactory effect, both on the *morale* of the working classes and upon the finances of the community. As we said in a previous article on this subject, wise and careful exercise of existing powers by the Guardians of the Poor would do much to solve the problem of the destitute and decrepit poor. We are glad to see that some of the Inspectors report that a good deal of progress has been made in regard to the classification of the inmates.

The Inspector for Kent, Sussex, and Surrey very rightly points to what is one of the greatest obstacles to economical administration by Board of Guardians. "Roughly speaking, one-fourth of the poor-law expenditure proper is contributed from imperial sources; and if to this be added rates derived from railways and tithe-rent charges, and from the premises of limited liability [and statutory] companies, in many unions, probably the amount paid by persons who could if they pleased exercise a controlling influence over the election of Guardians, would not amount to more than one-half of the sum annually expended. It is quite certain that . . . not much reliance can be placed on the vigilance of the ratepayer as a check to extravagant expenditure by Boards of Guardians. In former years these bodies have, perhaps with some amount of justice, been accused of a short-sighted penuriousness; but some indications may be observed that they are now apt to err by a too lavish expenditure." This is only confirmation of the view taken in these columns last week in regard to municipal competition with private trading—the man who pays is often outvoted by the man who only pays so indirectly as not to be conscious of his contribution, with the result that the public authorities spend the money of the one to please the other. It is little comforting to the ratepayer, though it is doubtless true, that for this state of things he has largely to thank the shortsighted parsimoniousness of his forefathers, if not of himself. The only way in which the tendency to extravagance can be checked, is by the greater attention of the ratepayers to their electoral duties. A reversion to the £10 voter is not in the range of practical politics.

The Inspector for the Eastern Counties has obtained statistics as to the number of aged paupers receiving outdoor relief in his district, over the ages of 60 and 65 years respectively. He states that there were 555 men and 1750 women between the ages of 60 and 65 years, and 6198 men and 12,424 women of 65 years and over, in receipt of outdoor relief in the Eastern Counties. Of the total number (50,209) of outdoor paupers of all ages, 75 per cent. were women and children. The 14,174 women who were over 60 years of age, it is to be observed, would be practically untouched by any scheme of old-age pensions that made evidence of thrift a condition precedent to the grant of a pension. From the statistics as to the ages of the outdoor paupers, the Inspector draws the conclusion that "comparatively few people come on the out-relief list between the ages of 60 and 65 years; but that after 65 they increase largely." A writer on the subject in "The Times" further inferred "that old-age pauperism for the most part only begins after 65; and therefore that the proposal of Mr. Chaplin's Committee to bring the grant of old-age pensions within reasonable limits, by disqualifying all persons having been in receipt of poor-law relief for 20 years before that age, would have little effect." Both inferences, it seems to us, lack sufficient warrant, because the statistics only state the present age of the paupers—they do not say how long those paupers have been in receipt of the relief they are obtaining, nor whether (as is very improbable), any of those persons received occasional relief between the ages of 45 and 65. The large proportion of women among the aged paupers appears to us the most noteworthy feature of the figures quoted. The same Inspector draws attention to the fact that parsimony in the provision and remuneration of relieving officers is an expensive economy, as overworked officers cannot give "that close attention to inquiries and visiting which is absolutely necessary for a proper administration of outdoor relief." This opens the door to fraud, and spells large expenditure, with, at the same time, insufficient relief of deserving cases; while, on the other hand, as is observed by another Inspector, "where there is comparatively little pauperism, and where out-relief is regulated with strictness, the general administration reaches a higher standard than elsewhere." Several Inspectors remark upon the growing scarcity of labour in the agricultural districts, and the consequent general rise in wages in those localities.

The foregoing, which only indicates a tithe of the valuable information contained in the annual report of the Local Government Board for the student of the difficult problems of pauperism in general and old-age pauperism in particular, is presented to the readers of the "JOURNAL," who, whether in their capacity as individual citizens or as employers of the poorer classes, must needs be interested in questions so prominent in the debates of the day—not at all as a coherent discussion of those questions, but as suggesting points to be borne in mind in their consideration.

OBITUARY.

Following closely upon the death of Mr. Thomas, the Secretary of the Plymouth Gas Company, comes that of Mr. JOHN WILLIAMS, who filled a similar position with the Devonport Gas Company, which took place on the 18th inst. Deceased was in his 67th year.

The death occurred quite suddenly, on Monday last week, of Sir RICHARD THORNE THORNE, K.C.B., Principal Medical Officer of the Local Government Board. Deceased was an eminent sanitarian, and was selected by the Government as their delegate at the first International Sanitary Conference in Rome, which was followed by others in Venice, Dresden, and Paris. He was 58 years of age.

We regret to announce the death, last Tuesday, at his residence, The Elms, Putney Hill, of Mr. HORATIO BROTHERS, M.Inst.C.E., F.G.S. Mr. Brothers had had a long connection with the gas industry. He was Engineer of the Equitable Gas Company more than thirty years ago; and after the amalgamation of the Company with the Gaslight and Coke Company in 1871 he remained in charge of the Lupus Street station until 1874, when he was transferred to Kensal Green; being succeeded by Mr. Alfred Kitt. After holding this appointment for a few years, he relinquished it, and was followed by Mr. A. C. M'Minn. Mr. Brothers was one of the earliest members of the British Association of Gas Managers, joining that body in 1869. He resigned, however, in 1878. He was Chairman of the Ceará Gas Company, and held an interest in other gas undertakings. Deceased was in his 78th year.

PERSONAL.

At the meeting of the Institution of Civil Engineers on the 12th inst., Mr. C. B. NEWTON, F.C.S., Gas and Water Engineer to the Carlisle Corporation, was transferred from the class of associate members to that of members.

We understand that Mr. H. WILLIAM CHISHOLM, the senior Auditor of the Gaslight and Coke Company, will not seek re-election in February next. Mr. Chisholm has served in the office for more than thirty-five years—being appointed in April, 1864; and the cause of his retirement is, we regret to say, ill-health as well as advanced years.

We regret to learn that, owing to defective eyesight, Mr. G. DUNBAR MALAM, who for nearly a quarter of a century has held the position of Engineer and Manager of the Bingley Gas-Works, has decided to relinquish it at the close of this year; and he has recommended that Mr. Corbet Woodall should be consulted upon the appointment of a successor, and regarding the character of certain extensions at the works. These matters were referred to in the minutes presented by the Gas Committee at the meeting of the District Council yesterday week, when the Chairmen of the Council and of the Committee and others expressed regret that Mr. Malam should have decided to retire.

London's Indebtedness.—The Finance Committee of the London County Council have issued a return for the year 1898 9 showing the charge on the rates of each parish, and the amount of loans outstanding for which each parish is liable in respect of parish loans, union loans, district loans, and central and county loans, together with the equivalent rate in the pound of the charge and the percentage of the loans outstanding to the rateable value of the parish. The total debt of London secured on the rates is now £43,349,646, and involves a charge of £2,710,583, of which £1,197,357 is interest and £1,513,226 repayment. The total debt is equivalent to 118¾ per cent. of the annual rateable value; and the charge is equivalent to an average rate over all London of 1s. 5¾d. in the pound. The debt of the City Corporation not secured on the rates is excluded from the return. At the end of 1898, it amounted to £4,445,962, and involved a charge of £309,435 a year.

Society of Engineers.—The forty-sixth annual general meeting of the Society was held on Monday, the 11th inst., at 17, Victoria Street, Westminster; the chair being occupied by Mr. John Corry Fell, the President. The following gentlemen were duly elected by ballot as the Council and officers for 1900: As President, Mr. Henry O'Connor (of Messrs. James Milne and Son); as Vice-Presidents, Messrs. Charles Mason, Percy Griffith, and James Patten Barber; as ordinary members of Council, Messrs. Joseph Bernays, D. B. Butler, G. A. Pryce Cuxson, W. H. Holttum, R. St. George Moore, Nicholas J. West, Joseph William Wilson, and Maurice Wilson; as Hon. Sec. and Treasurer, Mr. George Burt; as Hon. Auditor, Mr. Samuel Wood, F.C.A. The President briefly addressed the meeting; bringing before the members the salient points of the work of the past year. He also announced the premiums awarded by the Council for papers read during the past session.

NOTES.

Steam Raising and Boiler Fuels.

The Institution of Electrical Engineers have recently discussed the cost of steam raising and electric energy. It has already been stated in a "Note" that Mr. John Holliday told the Institution that the cheapest steam is that raised by coke-breeze fuel, burnt by means of a Perret furnace. Mr. R. E. Crompton has also studied the question, and finds the best way of burning low-grade fuel for steam raising in a modification of the old Juckes revolving grate. Attention was drawn to the fact that when a good use has been found for a low-priced fuel, it is apt to rise in market value until it ceases to be worth troubling about. Mr. Stromeyer, of the Manchester Steam Users' Association, also bore witness to the tendency of the prices of fuel to equalize themselves. Mr. Dugald Clerk testified to the unpopularity with manufacturers of water-tube boilers, on account of the cost of working, and pronounced against the idea of steam raising by means of producer gas. Professor Perry showed that the selection of the fuel is largely affected by the character of the load factor. Where the running of the plant is continuous, as in water-pumping, a poor fuel answers better than for intermittent work. Several speakers stated that coal loses calorific value very rapidly by keeping; one engineer declaring that stocked coal loses 25 per cent. of its fuel value in one month, and 33 per cent. in 2½ months. This is remarkable. On the whole, the discussion did not fully clear up the question whether poor fuel, such as coke breeze or "smudge" coal, is better burnt in a water-tube or Lancashire boiler.

Pitch and Tar in Road-Making.

The writer on road construction, in the admirable series of papers for students published by the "Builder," is greatly in favour of the extended use of coal tar and pitch for different kinds of road coverings. Of the two possible means of cementing granite paving setts and wood blocks—with portland cement or pitch—he is strongly in favour of the latter. It would be instructive to learn why the practice of road surveyors in the north and south of England differs so markedly in this respect. Dealing with the subject of road maintenance and cleansing, the writer lays stress upon the great advantages resulting from the use of tar macadam for broken-stone roads. It is remarked that the employment of tar macadam is growing in favour, especially by reason of its superior cleanliness. For macadam, being quite impervious to moisture, can be swept perfectly clean, and even washed without injury. The stones also, being held more firmly in position by the binding action of the tar, no movement can take place internally, and no mud can be formed except such as is produced by the natural wear of the surface. Repairs, too, are easily done by chipping out the affected parts, refilling with fresh tar macadam, and rolling in with a hand-roller. The cost of the maintenance of such roads is, therefore, considerably reduced. Elsewhere, it is shown that dust and mud are the worst foes of a good road surface. If gas managers everywhere would exert themselves to show the advantage of tar macadam for road making, they would perform a service to the public while helping to strengthen the market for tar and pitch.

Ventilation and Gas Fires.

A recent article in the "Ironmonger" intelligently discusses the problem of the ventilation of buildings. It is admitted that great diversity of opinion exists respecting the best arrangement for the purpose. In the matter of mechanically operated ventilation systems, there is perhaps a slight majority in favour of plenum, or pressure, over vacuum or exhaust systems. It is noticed that the standard of fresh air requirement per occupant has greatly risen of late years. In the earlier editions of Hood's text-book, 5 cubic feet of air per minute per head was the maximum allowed for ordinary conditions. This has crept up to 30 cubic feet, with a little more for schools. At present, 2000 cubic feet per hour is the maximum. Upon the question of the best position for air-inlets and outlets, preference is given to two outlets for every room—one near the floor (say, in the skirting), the other at the top near the ceiling. This double provision is to meet the views of those who urge that there is always some cooled carbonic acid gas and other products of combustion and respiration at the floor level, which should be removed; while at the same time clearing off the same impurities existing in a warmed state at the ceiling level. In the case of an ordinary room, the open fireplace constitutes the lower level extractor; while a 9 inch by 6 inch chimney breast ventilator, as near the ceiling as possible, will do the rest. The great drawback to this arrangement is the too energetic action of the chimney when the fire is burning, which causes draughts. If the open coal-fire were replaced by a well-fitted gas-fire, with a flue discharging into the chimney—otherwise blocked off—the objection would be overcome. How the requisite supply of fresh air can best be provided, without having recourse to the crude and (in winter) impossible expedient of the open window, is not stated.

The Invention of the Steam-Blast for Locomotives.

The attempts recently reported from the United States and elsewhere to restore coke to its old position as the chosen fuel for locomotives, lend additional interest to some particulars of the achievements of Timothy Hackworth, a neglected inventor, contributed by Mr. Thomas Greener to the "Journal of the Society of Arts." The reputation of Timothy Hackworth has not been able to endure against the overshadowing celebrity of George Stephenson; but it is stated that it is to the skill and enterprise of the former that steam locomotion owes three of the points essential to its success—the smooth wheel on the smooth rail; the steam-blast; and the multitubular boiler. The steam-blast for inducing such a draught as would enable a locomotive to burn coke in proportion to its needs, was first applied in Hackworth's engine, the "Royal George," built in 1827. George Stephenson is credited with making the same invention; but he turned the exhaust steam from his cylinders into the chimney, through two pipes carried into it on opposite sides. Mr. Greener states that he had personal knowledge of Hackworth's invention, the essence of which was to concentrate the two exhausts in one conical pipe, with a greatly reduced orifice, taking care that it was pointing up exactly in the centre of the chimney. Thus Hackworth obtained the self-adjusting draught necessary to keep up steam under all conditions of speed or weather. Engines fitted with Stephenson's steam-blast could only go at an average speed of 4 miles an hour. He endeavoured, in 1828, to improve the draught for burning coke by means of two bellows worked by eccentrics underneath the tender, which was a failure. Although Smiles, the biographer of George Stephenson, was informed by Mr. Greener of the part taken by Hackworth in the improvement of the steam locomotive, justice has not hitherto been done to his memory.

Colour-Temperatures.

Some recent observations have been made by Messrs. White and Taylor, of Bethlehem, Pennsylvania, U.S.A., on the colours of heated steel, and the temperatures corresponding therewith. The authors find that the technical literature of this important practical matter is so vague and contradictory as to be valueless. The chief reason for this is to be found in the defective apparatus used by the older experimenters for determining the higher temperatures. It is only with the introduction of the Le Chatelier pyrometer that exactitude in this regard has become possible. The first work with this instrument in relation to heat colours was that of Dr. H. M. Howe, some eight or nine years ago, which was never published. The authors are enabled to describe it. The great difficulty in classifying heat colours and the corresponding temperatures rests in the conditions of observation—so much depending upon the observer's eye for colour, and the light in which the hot metal is seen. Still, after many experiments, the authors have arrived at the following nomenclature of heat colours and the corresponding temperatures in degrees Fahrenheit, as suited to the ordinary conditions met with in smiths' shops:—

	Degrees.
Dark blood red, black red	990
Dark red, blood red, low red	1050
Dark cherry red	1175
Medium cherry red	1250
Cherry, full red	1375
Light cherry, bright cherry, scaling heat,* light red	1550
Salmon, orange, free scaling heat	1650
Light salmon, light orange	1725
Yellow	1825
Light yellow	1975
White	2200

The scaling heat (*) is that at which scale forms and sticks to the metal after it has cooled in air.

TECHNICAL RECORD.

THE MERTHYR TYDFIL WATER-WORKS.

The members of the Association of Municipal and County Engineers residing in the South Wales district assembled at Merthyr Tydfil a short time since, under the presidency of Mr. W. Harpur, of Cardiff, to hear and discuss a paper by Mr. T. F. Harvey, Engineer and Surveyor to the Merthyr District Council, on the Merthyr Water-Works, and to visit the works in progress in connection with the construction of the Upper Neuadd reservoir, for impounding the waters of the Taff Fechan. The paper furnished the following particulars:—

The area over which the Merthyr District Council have jurisdiction is 17,759 acres in extent, and has a population of 72,000. In 1852, a Company obtained an Act of Parliament to provide a water supply for Merthyr; but the works were not carried out. In 1858, the Local Board of Health obtained their first Water Act, authorizing them to impound the waters of the Taff Fechan, for the supply of their district, according to the plans of the late Mr. Thomas Hawksley, who carried out the whole of the works. The capital expended amounted to £82,000; and from this time the district has had an abundant supply of the purest water, except in seasons of long drought. The impounding reservoir of this scheme drains an area of 4500 acres, chiefly mountain pasture on the old red sandstone; and a further 500 acres on the south-east side of the reservoir is intercepted by a branch of the 14-inch main. The embankment, which is an earthen one, crosses the valley at a narrow neck. Its height is

34 feet above the river bed, and 1084 feet above Ordnance datum. Although the embankment is only a shallow one, the area of the top water is 96 acres, and the capacity of the reservoir 346 million gallons. If the embankment had been made 500 yards farther north, and its height doubled, the reservoir would have had a top-water area of 190 acres, and a capacity of at least 1500 million gallons. Moreover, the cost of such an embankment would have been absurdly small for the volume of water which would have been impounded. Such a reservoir would have done away with the necessity for the additional storage now being provided, as well as of other works. A 14-inch main, 6¼ miles in length, conveys the water from the reservoir to the filtering and pumping station, where (until a second storage reservoir was constructed in the upper part of the watershed) a pair of vertical engines of the condensing type pumped water to a covered service reservoir of 343,000 gallons capacity in the upper part of the district, at an altitude of 1205 feet. This filtering station comprises two open depositing tanks, 153 feet by 66 feet, and 7 feet deep, four filter-beds, 100 feet by 50 feet each, and a covered service-tank, 99 feet by 65 feet, and 15 feet deep. The 14-inch main is continued from the filter-beds to Merthyr, a further distance of 1¼ miles, and thence a smaller main supplies the outlying places six miles down the valley. In consequence of the expansion of the district, and especially of the deep sinkings to the steam coal in the southern portion of the district, it was deemed advisable to have an additional storage reservoir; and in 1876 a Provisional Order was obtained, and the Lower Neuadd reservoir afterwards constructed. This reservoir obviates the necessity for pumping; the top water-level being 1412 feet above Ordnance datum. The capacity when full is about 75 million gallons. An independent line of 12-inch main takes the water to separate filter-beds at such a height as to flow therefrom by gravitation to the old service reservoir at the end of the pumping-main, near the highest part of Dowlais, for the supply of Dowlais and other high parts of the district, and thence by a smaller main to the southern part of the district, a further distance of 8½ miles, for the supply of about 8000 persons within the district, and 3000 outside the Council's area. At Treharris, the author is now constructing for the Council an open service reservoir of lime concrete, to contain 350,000 gallons.

In 1886, Mr. Harvey marked out a site about half-a-mile north of the Lower Neuadd reservoir which he considered a suitable one for an embankment, should further storage capacity become necessary; but, owing to protracted litigation, it was not until 1895 that an Act was obtained under which the Upper Neuadd reservoir is now in course of construction by the Engineer for the works, Mr. G. F. Deacon. The author is the Resident Engineer; and the site of the dam is virtually that selected by him in 1886. In October, 1895, the Council advertised for tenders for excavating and embanking earth and rock, providing and delivering materials for masonry and concrete, and for other works, and accepted the tender of Messrs. Holme and King, of Liverpool and London, whose offer, however, was not the lowest. Under the contract, the work is done partly by the Contractors and partly by the Council. The portion done by the Contractors includes the supply and delivery of all materials, the excavation and timbering of the trenches, all works of a temporary nature, and all machinery, locomotives, gantries, and apparatus; while the work of the Council's own men consists of the actual building of the permanent dam, whether in concrete or masonry. None of the Contractors' men are engaged upon the dam itself. The principle involved in this dual execution of the work is that of endeavouring to leave no loophole for defective building of the dam. The reservoir will contain about 350 million gallons; the surface area at the top water-level being 59 acres, and the drainage area 2018 acres. The height from the bed of the river at the vertical face of the dam to the top water-level is 67 ft. 3 in.; the level of the overflow being 1506·5 feet above Ordnance datum. The total length of the dam is 1622 feet, of which 1390 feet will be visible above ground. The dam crosses the valley nearly east and west; the formation being the old red sandstone. The height of the dam from the foundation to the footwalk is 84 ft. 6 in. The face of the dam is built to a straight line in plan, except the overflow portion in the middle part, which is curved convexly towards the reservoir to a radius of 310 feet. The overflow portion between the pilasters or ribbons is 89 feet in length, which near the top is divided into six bays of 12 feet each, in which will be fitted greenheart stop planks to a depth below overflow level of 4 feet. On the east side of the overflow, a tower will be carried up to a height of about 55 feet, which will contain the tank for flushing the intake and strainer, and the lower part of which will serve as the valve-chamber. The west side will be finished by a turret, and a planked footbridge will be constructed over the overflow. Whatever the height of water in the reservoir, the water for the main (which will be 16 inches in diameter) will be drawn from near the surface, and will be strained through frames of copper wire gauze, without reducing the reservoir head upon the pipes to that of the outlet-level. The general principle adopted in cleaning the strainers is a modification of that employed by Mr. Deacon at Lake Vyrnwy, where the strainers, after being raised above the water, are perfectly cleansed by a reverse current from a series of pipes caused to revolve automatically, turbine-like, within them. At Upper Neuadd, cleansing will be performed more simply, without lifting the strainers.

The foundation on both sides of the middle part of the dam is taken down through the drift, and through a considerable depth of marl and loose rock to sound rock, or, near the end of the trenches, to hard marl. The trenches, both east and west of the overflow, taper in plan from a width of 48 feet at the side of the overflow to a width of 15 ft. 6 in., which width is carried on to the ends of the embankment, and is then gradually reduced to 3 ft. 6 in., which narrow width is continued to the end of either side. The timbering of the trenches has been done by the ordinary method of polling-boards in settings 3 feet apart, struts 12 to 13 inches square, walings 12 by 6 inches, and polling-boards 1½ and 2 inches thick. The struts were 8 ft. 6 in. from centre to centre, giving a clear space of 7 ft. 6 in. for the lowering of the materials. The concrete below the original surface of the ground is either Portland cement or Aberthaw pebble lime concrete; the former only being used for a limited thickness over the rock foundation and up the water face. All the concrete is made by adding broken stone to previously prepared fresh mortar; the mortar used for concrete and for masonry being identical. It is composed of rock sand and pebble lime or cement, as the case may be. The proportions of the cement concrete are: 4 parts of broken limestone to 1¾ parts of mortar, consisting of two parts of rock sand to 1 part of cement; and of the lime concrete, 4 parts of broken limestone to 1¾ parts of mortar, consisting of 2½ parts of rock sand to 1 part of hydrate of lime. There can be no doubt that the Aberthaw lime, properly treated, makes an excellent mortar for hydraulic work; and it will keep on improving in strength for a long period.

In conclusion, the author mentioned that this is only the second dam constructed in this country in which the cementing material is mainly hydraulic lime mortar; the Kendal (Fisher Tarn) reservoir being the first. The valves were closed in February last at the Kendal reservoir, and the water is now within a few feet of the overflow. The Engineer (Mr. G. F. Deacon) states that the dam is quite water-tight.

Mr. G. F. Deacon having proposed a vote of thanks to Mr. Harvey, Mr. Williams asked why limestone had been brought from a distance for the works, when there was an ample supply of sandstone in the district. Was it that limestone was more suitable for the work? Mr. Yabbicom said he had recently had practical experience of a forty years' test of mortar made from Aberthaw pebbles. His predecessor at Bristol used this limestone mortar for drainage work forty years ago—the clean Aberthaw pebbles being ground with furnace ashes; and on recently cutting into the sewers, he found that the bricks had worn away with the scour, but that the mortar remained intact. Mr. Orton asked if any difficulty had been experienced in taking the timber from the trench. Mr. Cox said he had had a case in which Aberthaw lime had been used for reservoir work, and after ten years it was as loose as the day on which it was put in. He should therefore like to know whether the Engineers considered it a safe material for such work. Mr. Wyrill also asked why the local stone was not used. With reference to the section of the dam, the profile appeared very light; and the only question of stability referred to in the paper was that the power of resistance came in the middle third of the dam. The President expressed the opinion that a wise course had been followed in building the dam by administration, and not by contract. The Cardiff Corporation found, in the construction of the reservoir on the Taff Fawr, that this was the only course they could follow; and it had been adopted in several other cases in which Mr. Deacon was the Engineer.

The vote of thanks having been unanimously accorded, Mr. Harvey, in reply to the questions put to him, said the use of limestone in preference to any other stone was determined partly by experiment and partly by practical knowledge. The weight of the limestone was rather heavier than the red sandstone; and the experiments proved that mortar made from the limestone stood a higher tensile strain. He was interested in Mr. Yabbicom's remarks as to the condition of old mortar at Bristol; and there was no doubt that, if properly prepared, Aberthaw lime was a most excellent material. The lime referred to by Mr. Cox could not have been perfectly prepared. Mr. Deacon remarked, with regard to the use of hydraulic lime concrete, that one property had not been alluded to—viz., that the permanent elasticity of limestone concrete was greater than that of portland cement concrete. A rod of portland cement concrete submitted to all changes of temperature would crack more, though its strength would be greater, than a rod of hydraulic lime concrete. It was a material that would not crack that was wanted more in works of this kind than the element of strength. It had been mentioned that the dam looked light; but the pressure fell very largely upon the middle third, and the dam was stronger than many others. The timbering, he admitted, was hard to take out where the ground was bad, but exceedingly easy wherever it would stand for a depth of 3 feet. He had taken a great deal of interest in the matter of rainfall, and felt that the way in which some engineers depended upon a single gauge was most hazardous. They had a battery of gauges placed within a distance of 200 feet, which showed a variation of nearly 50 per cent.

The members then proceeded by special train to Torpantau, and thence by the water-works truck train to the site of the reservoir, where luncheon was provided. The remainder of the afternoon was devoted to an inspection of the works described in the paper.

THE COST OF PRODUCING CARBIDE BY DIFFERENT AGENCIES.

The following is an abstract translation of a paper on the "Cost of Production of a Ton of Calcium Carbide with Different Sources of Power," read by Herr F. Liebetanz, of Düsseldorf, before the recent Acetylene Congress at Buda-Pesth. The paper was referred to in our notice of the proceedings at the Congress (*ante*, p. 939); and it has been printed in its entirety in a recent number of the "Zeitschrift für Elektrochemie."

The growth of the acetylene industry has raised the carbide industry to one of national importance; and it is therefore desirable that the essentials for a profitable prosecution of carbide manufacture in any country should be clearly realized. Hitherto it has been deemed necessary that there should be available water power, and good raw materials at a low cost. Clearly it is requisite that good raw materials should be near at hand, so that their cost is not greatly enhanced by heavy freight charges; but it does not follow that water power is equally essential. Available water power is restricted to a few districts in a few countries; and as heavy freight on carbide has so far made the cost of acetylene prohibitive elsewhere, it was expected that acetylene lighting would have progressed to a more marked degree in the favoured districts. Thus in the German Empire acetylene is used to the largest extent in the south, which is near Switzerland, where there is ample water power, and in Westphalia and the Rhine Provinces, which are near the ports of Antwerp, Rotterdam, Bremen, and Hamburg, to which foreign carbide can be brought at low rates. In France, similarly, acetylene is most used in the south, especially in the Savoy district, where the carbide industry has been firmly established. Clearly, therefore, apart from the districts of Switzerland, Scandinavia, France, North America, Italy, Austria-Hungary, and Germany, where water power is available for the manufacture of carbide, attention should be directed to other sources of power for the purpose. Among these may be mentioned steam power, the energy of the tides, wind power, blast-furnace gas, and acetylene. For the consideration of the subject of the relative utility of such sources of power, it would be necessary to take into account small carbide works quite as much as those of many thousand horse power. The first question, therefore, to be answered is whether small carbide works could be advantageously established.

The following considerations will aid in framing a reply to this query. The work performed by an electric current is proportional to its strength, its tension, and the resistance overcome. The unit of electrical work is the product of the strength of the current and the tension (or electromotive force), and is known as the voltampère or watt. 1000 voltampères = 1 kilowatt; and 736 voltampères = 1 electrical horse power. One watt produces heat equal to 0·24 small calories per second; and consequently one electrical horse power produces $736 \times 0{\cdot}24 = 176{\cdot}64$ small calories per second. Hence is derived Joule's law that the heat developed in a given time is proportional to the resistance of the conducting wire and to the square of the strength of the current.

According to a calculation made by Pictet, when one molecular proportion (64 grammes) of carbide is to be produced from the mixture of lime and carbon, 182·5 large calories must be imparted to the mixture. Actually, only 102·6 calories are used in the formation of the carbide, while the balance is spent in heating up the mixture. Consequently 1 kilogramme of calcium carbide needs for its production 2850 calories, or 3300 watt-hours, or 3·3 kilowatt-hours, which corresponds to 4·5 horse-power-hours.

Dr. Sieber calculated that the maximum theoretical output would be 9·38 kilogrammes of carbide per electrical horse power per 24 hours. He arrived at this figure thus: The heat of formation of lime per (gramme) molecule = 132 calories; and there is to the good the heat of formation of the carbonic oxide = 28 calories per (gramme) molecule. Therefore 132 − 28 = 104 calories have to be supplied by the electric current in order to effect the reaction. Then 1 watt-hour = 0·864 calorie; and 1 molecule of calcium carbide requires therefore 104 ÷ 0·864 = 120·4 watt-hours. So that 1 watt-hour yields 0·53156 gramme of carbide; and consequently 1 electrical horse power per 24 hours yields the aforementioned 9·38 kilogrammes of carbide. But in this calculation no account has been taken of the energy which has to be expended in raising the mixture of lime and carbon to the temperature at which the reaction occurs. In practice, for the production of 1 kilogramme of carbide about 1·3 kilogrammes of carbon and 1·4 kilogrammes of lime are taken in place of 0·6 and 0·9 kilogramme respectively, which are the amounts required according to theory. [In a few instances with improved furnaces, smaller quantities have proved sufficient.] For heating 1·3 kilogrammes of carbon to 3000° C., which may be taken as the temperature at which the reaction occurs, 1950 calories would be needed; and for heating to the same temperature 1·4 kilogrammes of lime, 840 calories would be required—making a total of 2790 calories which corresponds to 3230 watt-hours. Therefore, for the formation of 1 kilogramme of carbide, there are required 3230 watt-hours for heating the materials, and 1900 watt-hours for the reaction—making a total of 5130 watt-hours. Consequently 1 electrical horse power per 24 hours yields only 3·44 kilogrammes of carbide, if it is assumed that, in addition to the heat rendered latent by the reaction, the whole of the heat required to bring the materials to the temperature of the reaction is wasted so far as the smelting process is concerned. The yield of carbide, therefore, should vary between 3·44 and 9·38 kilogrammes per electrical horse power per 24 hours. But only the heat radiated that is from the furnace, and that carried off by the hot carbonic oxide and carbide which are removed from the furnace, are actually lost to the process, as the remaining heat passes into the freshly supplied raw materials and diminishes the consumption of current, or increases the yield for the same expenditure of energy. These theoretical figures find confirmation in the following results of practical working.

A firm, whose electric furnaces enjoy an excellent reputation, guarantee unconditionally a yield of 5 kilogrammes (11 lbs.) of carbide per kilowatt per 24 hours, and consider that actually 6 kilogrammes can easily be produced. Two of their furnaces—each of 130 kilowatts—working under unfavourable conditions, actually gave such a yield. It may, therefore, apart from every consideration of the particular type of furnace employed, be taken as granted that practically at least 5 kilogrammes (11 lbs) of carbide are obtainable per 24 kilowatt-hours. For the production of 1000 kilogrammes (2204·6 lbs.), there would therefore, on this basis, be needed 200 kilowatts, or about 272-horse power available at the electrodes. In order to compensate for loss in the transmission of power to the electrodes, considerably greater power must be available at the plant by which the power is generated. The loss is not the same in all cases and at all times. It varies with the types of dynamos and prime movers, and with variations in the feed of water to turbines or of fuel to boilers. The dynamos have a higher efficiency than the rest of the plant. A reliable allowance is an efficiency of 75 per cent. for the whole of the engines, &c. Therefore 25 per cent. has to be added to the 272-horse power, making 340-horse power as the energy which must be developed at the shaft of the prime mover. As the dynamos, however, have likewise been assumed to show a loss of energy of 25 per cent., the available force must be increased to 425-horse power. The dynamos are usually placed near the furnaces; and the loss in the conductors will not exceed 7 per cent. The power for the production of 1000 kilogrammes of carbide may therefore be taken, in round figures, at 450-horse power at the prime mover [= 457-horse power per ton (English) of carbide]. The figures here taken may appear too high; but practical experience shows that the usual estimates are too low. The question for consideration is: What is the cost of the 450-horse power required, when obtained from different sources?

There are reliable data derived from practical trials available, so far as water and steam power are concerned; but the data are less complete with regard to blast-furnace gas. Wind motors give suspiciously variable results; while tidal motors appear to be as capricious as the sea itself.

The cost of water power is dependent on the cost of the unimpounded power, of impounding it, and of the water-motors. A large number of figures, for installations ranging from 200 to 40,000 horse power, which are in the author's hands, enable him to deduce a fair average cost therefrom. For the unimpounded water power, the cost averages £5 per horse power; and the average expense of impounding, and of the turbines and mains, is £10 per horse power. Therefore, at a total cost of £15 per horse power, the 450-horse power needed will entail an initial expenditure of £6750. An allowance of 10 per cent. for amortization will be ample under all circumstances; and therefore the annual charge will amount to £675 for the 450-horse power required.

For the use of steam power, cheap fuel is, above all things, essential; and attention is naturally turned to brown coal or lignite. But this must possess a reasonably high heating value, its price must not exceed about 3s. per ton at the pit mouth, and the cost of transport thence to the works must be very low. Secondly, water suitable for feeding the boilers must be at hand. The fuel required for the boilers may be computed from the knowledge of the fact that 1 lb. of each of the fuels named produce the following number of pounds of steam: Coal about 8; brown coal 3; peat 2½; coke 7; and wood 4. Supposing, therefore, that brown coal is used for the boilers which supply compound engines, and assuming that 14⅓ lbs. of steam are required per horse power, the amount of brown coal needed to furnish the 450-horse power will be $\frac{14\frac{1}{3} \times 450 \times 24}{3} = 51{,}600$ lbs. per 24 hours, which, at 3s. per (metric) ton, will cost about £3 10s. 2d. The cost per year of 300 working days will thus be £1053 with brown coal. Ordinary coal costs about 9s. per ton at the pit mouth, and produces eight times its weight of steam. Again, assuming that 14⅓ lbs. of steam are needed per horse power, the consumption of coal per 24 hours for the production of 450-horse power will be $\frac{14\frac{1}{3} \times 450 \times 24}{8} = 19{,}350$ lbs., which, at 9s. per (metric) ton, will cost nearly £3 19s. The cost per year of 300 working days will therefore be £1184 11s.

Supposing it has been decided to apply steam power for the manufacture of carbide in a district where water power is not obtainable, the installation needed for the production of a (metric) ton of carbide per 24 hours would be somewhat as follows: A compound condensing engine of 450 effective and

500 indicated horse power, working at 8 to 9 atmospheres pressure, costing, with all accessories, about £2150. A tubular boiler of 2777 square feet heating surface, comprising 160 tubes 3¾ inches in diameter and 16·4 feet long, and having a diameter of 4 ft. 5 in. and a length of 21 ft. 4 in., designed for a maximum pressure of 8 atmospheres, costing, with accessories, £650. The whole of the remaining plant will cost about £2350—making a total outlay of £5150. Allowing 10 per cent. for amortization on the engine and boiler (£280), and adding thereto the cost of the fuel consumed (£1184 11s. for ordinary coal), the total outlay is £1464 11s. for 272-horse power available at the electrodes. This is equal to £5 8s. per effective horse power per annum.

The cost of raw materials and the wages must be subject to great variations according to the locality. For the steam power works which the author has in mind in the estimates given above, the raw materials cost £2 12s., and the electrodes 16s. per (metric) ton of carbide. The daily expenditure, including rent, lubricants, wages, amortization, &c., is £6 16s., or including the cost of power £11 14s. The daily expenditure in a water-power works of the same capacity is £6 8s., or including the cost of power £8 8s. The cost of a (metric) ton of carbide is therefore £11 14s. by steam power and £8 8s. by water power, or £3 6s. less by water power. A profit of 10 per cent. makes the selling price of the carbide produced by steam power £13 8s. It is evident, however, that a steam carbide works will not be altogether unprofitable if properly established in a favourable situation. Water power has disadvantages. For instance, the power available varies from time to time, and the variations interfere with constant working; while the position of a works is necessarily restricted to particular sites, where the opportunities for disposing of the carbide may be very indifferent.

Water power will be used wherever it is available; but it is only obtainable in some localities, and the freight thence to the centres where the carbide is consumed for lighting purposes will often be high. Therefore, under favourable conditions, a steam-power works erected at the place of consumption will be able to compete with a distant water-power works. In a case in point, the freight per (metric) ton to the spot where a steam-power works is located is £2 18s.; and if this sum is deducted from the cost of carbide there—viz., £11 14s.—there remains £8 16s. as the cost at which the water-power carbide must be produced in order that it may compete with the carbide from the steam power works in the vicinity of the latter. A steam-power works disposing of its carbide locally, will be able to make a good profit wherever freight charges are at all high and water-power carbide works are at a distance.

Turning to blast-furnace gas as a source of power, it must be remembered that there are two difficulties in the way of its application. Its heating value is low, and it is contaminated with fine particles of metals and their compounds, which can only be separated from it with great difficulty. It is, of course, far better to use the gas in gas-engines than for heating boilers, as the gas-engine converts 20 per cent. of the heating value of fuel into work, whereas the steam-engine only utilizes about 12 per cent. of the heating value of the fuel. At the Phœnix works, among others in the Rhenish-Westphalian district, experiments have recently been made on the application of blast-furnace gas to carbide manufacture, with two electric furnaces of a capacity of 13 kilowatts. The experiments are said to have been satisfactory. What enormous quantities of blast-furnace gas are available, appears from statistics collected by Herr Lürmann, of Osnabrück. For every ton of raw iron produced, there are obtained nearly 160,000 cubic feet of blast-furnace gas. About 8 of the 20 horse power that this gas represents may be required at the works; but the 12-horse power is available for carbide manufacture. In 1897, Germany and Luxemburg produced 6,889,067 (metric) tons of raw iron; and the blast-furnace gas available for carbide manufacture would, on this basis, represent 82½ million horse power. It would be useless to repeat particulars of the actual cost of carbide manufacture by means of blast-furnace gas, as the trials have as yet been only a short time in progress.

Wind power is too fickle to be used seriously for carbide manufacture, though lately the "Ventokat" motor has given a far higher efficiency than earlier wind-motors. With regard to the utilization of the power of the tides, the only practical results are those of experimental trials of motors—such as the Knoblauch motor, which is being tested at Harburg-on-the-Elbe. Another source of power which should not be overlooked is that of rivers in which the flow is not rapid. This, indeed, by rights is a form of water power; but it differs essentially from the power of falls, which was alone considered under that heading. Though rivers abound in all parts, their power is rarely utilized, because of the small duty afforded by the motors. Recently, however, Herr von der Heydt, of Bendorf, in Prussia, has designed a floating weir with a screw turbine, which has an efficiency of 60 per cent. The absolute power needed to return the 272-horse power required at the electrodes would be about 540-horse power, in order to have a sufficient surplus for emergencies. The cost of construction and of plant for this power would be £3750; and the expenses, including 16 per cent. amortization, maintenance, and wages, would be £1000 per annum, or about £3 7s. per diem. This is equivalent to about £3 14s. per effective horse power per annum. This power is, therefore, 65 per cent. dearer than water power from falls, but about 22 per cent. cheaper than steam power. A very great disadvantage, however, is that it would be interrupted by floods and frost. Nevertheless, Dr. Möller, of the Technical College at Brunswick, has recently expressed the opinion that the power of running streams can be profitably utilized.

The chief conclusions arrived at in this paper are summarized in the following table of the cost of power per ton of carbide produced. [The table in the original refers to the metric ton of 1000 kilogrammes; the appended table gives the proportional figures for the English ton.]

Production of One Ton of Carbide per Diem.

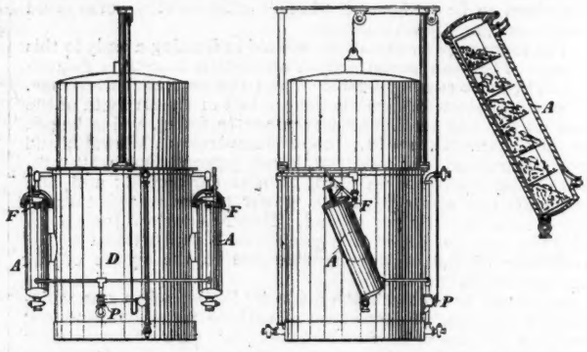
—	By Water Power.	By Steam Power.	By Power of Running Streams.
	£ s. d.	£ s. d.	£ s. d.
Cost of installation . . .	6858 8 0	2845 0 0	3810 4 0
Annual maintenance charges	685 17 0	1488 0 0	1016 0 0
Annual cost of one electrical horse power at the electrodes	2 10 0	5 8 0	3 14 0
Actual cost of a ton of carbide	9 1 0	11 18 0	9 18 0

REGISTER OF PATENTS.

Acetylene Generators.—Ellen, W., of Manchester. No. 24,501; Nov. 21, 1898.

This invention relates to that type of apparatus in which water flows by gravity into a generator containing carbide, and the acetylene is conducted from the generator into a gasholder bell, the rise and fall of which shuts off and opens the water supply; the object aimed at being to render the working of the generator more uniform and reliable, and to prevent accidents.

One or more (preferably) cylindrical generators A are fixed to the side of the gasholder-tank D, in a slanting position, so that the axis of the cylinders makes an acute angle with the vertical axis of the tank. The bottom of the generator is fitted with a cock for letting off the water and sediment when the carbide is exhausted; while the water is fed into the generator near to the bottom end. The patentee prefers to place the carbide in the tin receptacle made in one piece, and provided with a series of divisions with clearance spaces between them. These receptacles (after



being charged) are placed in the generator; and the diameter of the tins being less than that of the generator, allows the gas to pass. By this arrangement, the water flows into the several divisions successively, and the generation of acetylene proceeds gradually; while the lime remains behind and can be readily removed.

The gas passes from the generator near the top, through a pipe F, fitted with a cock, on the plug of which is fixed a handle connected by a link to the cover of the generator, which is preferably hinged to the generator cylinder, and made tight by the usual bow and screw. The cock is so arranged that the action of opening the cover turns the handle, and the cock is shut off, and opened again when the cover is closed. The gas is led into a stand-pipe inside the gasholder tank, which is preferably covered by a hood causing the gas to escape below the water-level in the tank, and being washed thereby; and the gas is taken out from under the bell in the usual way. The rise and fall of the bell closes and opens the water-supply cock or tap P, by means of the cord or chain R in the ordinary manner.

Time Measure for Gas-Stoves and other Lighting with Coin-Freed Mechanism.—Glover, R. T. & J. G., of Clerkenwell. No. 26,165; Dec. 10, 1898.

This invention is chiefly intended for use in the bedrooms of hotels and the like, in which, should heat or a light be desired, it is only necessary to drop a predetermined coin into a slot, move a handle, and light the stove or burner. Should a portion paid for be unconsumed, a lever or bolt can be moved to shut off the supply and simultaneously close the valve, and also stop the clockwork so as to be ready for relighting at some future time; or if a light is left burning, the consumption will go on until the quantity paid for has been consumed, or, by turning off a branch tap of the supply-pipe, the flow of gas can be stopped, and the clockwork be allowed to run down.

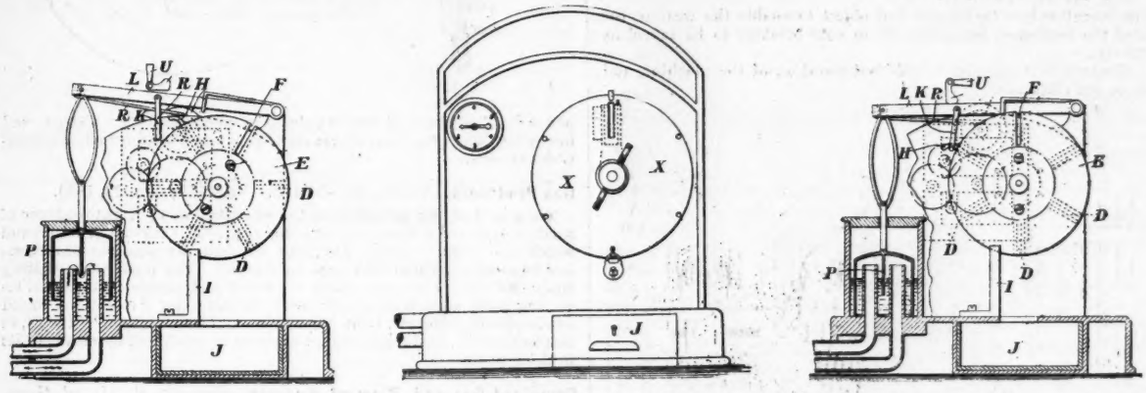
The illustrations show a part sectional elevation of the arrangement with the casing and front or price-changer plate removed (the gas-passage being open), a similar elevation with the gas-passage closed (the valve-lever being controlled by a spring), and a front outside elevation of the apparatus as seen by the public.

On a central axle are a notched wheel C with six pockets D, and a face plate E with a single slot F; the latter plate being adjustable by

screws, to suit the notch of the plate C, with which it can be affixed to suit the value of the coin to be inserted and the period of time which the gas has to flow in return therefor. The plate C has a claw or stud H affixed; and when the coin-plates C E are moved over the necessary distance, the coin strikes against a fixed stop I, and causes the coin to fall into the money-till J for after-collection.

The movement of the two plates C E winds up the spring of the clock, and simultaneously removes the stud H from the link K of the top bar L, which rises under the action of a spring sufficiently to raise the gas-valve P out of the mercury shown in the cup for the free passage of gas from the supply-pipe to the burners. The clock-gear (by the rebound of its spring) reverses the direction of travel of the two plates, until the claw H re-enters the link K. The link and bar are drawn down again by the claw; and this, by lowering the valve P, shuts off the supply. The rotation of the clock-gear is also stopped by the lever R bearing against the arbor of the escapement wheel, or by pressing on the balance wheel of the clock-gear. There is a cam lever, the edge face of which can, by turning the handle U, depress the bar L at any time when the gas has to be shut off and the clock-gear stopped—such as when a person desires to reserve the supply of unconsumed gas for which he has paid.

The apparatus is enclosed in a casing; and to protect the mechanism there is a front plate X, which is adjusted so that, on the meter stopping, the slots in the disc C and plate E are in line with the slot in X. The front plate carries at its back a guard or shield (Patent No. 25,272 of 1894), in which a coin-receiving pocket is formed; the shield being pivoted to the plate, and capable of separate rotation by an outside



handle, so that, unless a coin be in such pocket, the shield is free to be turned by hand without affecting the mechanism of the apparatus. But if a coin be inserted, it becomes locked within the pocket, also in the slot F of the disc E, and likewise in the notch of the fixed back plate C, so that all three move at once (and as one body) to wind up the clock-spring.

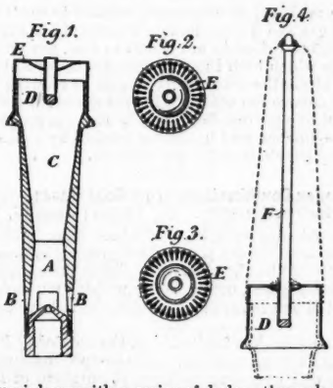
If, as in some cases, it is desired that all the gas paid for should be burnt by a continual light, a notched cam is arranged within the path of the claw H, which, at the termination of the gas consumption, enters a notch of the cam, and moves it round against the pressure of a plate spring until a leg on the bar L falls into the notch of the cam, the drop of which leg lowers the valve P into the mercury, and shuts off the flow of gas, assisted in its fall by a weight.

When a fresh coin is inserted through the front plate X, it lodges in a pocket at the back of it, and enters the notch F of the plate E; so that when the handle is turned both plates E C are carried round by the temporary locking of the coin between them, until the coin strikes the fixed stop I, and falls into the till J. It is not possible to insert a fresh coin until the quantity of gas already paid for has been consumed, because the face plate E has only one notch, which must, when brought to the full end of its back travel, be directly behind the slot of the front plate.

Incandescent Burners and Mantle-Supports.—Duncan, J. H. H., of Coleman Street, E.C. No. 27,205; Dec. 23, 1898.

This invention has reference, *inter alia*, to the construction of bunsen burners of the kind in which a mixture of air and combustible gas is supplied through a burner-tube, the interior of which is of gradually decreasing cross sectional area from its lower end (where the air and gas enter it) up to a certain point, from which point the interior of the tube is of gradually increasing cross sectional area to the top—such, for instance, as is described in the De Mare patent No. 10,497 of 1894.

According to the present invention, the upper end or head of the burner-tube (of cylindrical, conical, or flaring shape) is made plain—that is to say, without lateral perforations, and without any centrally arranged guiding surface. It is provided at the top with a plate formed



near its outer periphery with a series of holes, through which the mixture of air and gas flowing upward through the burner-tube can directly pass without abrupt change of direction, and "being ignited on the outside of the head of the tube, will produce flame that will impinge upon an incandescence mantle supported above the head."

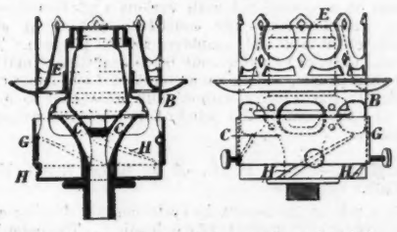
Fig. 1 shows in vertical section, and fig. 2 in plan, burner-tube comprising a lower truncated conical or approximately conical portion A, provided at the bottom with lateral air-inlet holes B, and a centrally arranged gas-inlet nozzle; a plain intermediate inverted conical or approximately conical portion C; and a plain cylindrical upper portion D—the three portions being arranged co-axially one above the other, and integral with one another. The upper cylindrical portion of the tube may be of approximately the same diameter as the upper end of the intermediate portion; and it is partially closed by a top-plate, formed with an annular row of circular holes E arranged near together—each hole having extending from it towards the centre of the plate a narrow slit of a length (say) about twice the diameter of the hole. Fig. 3 is a similar view to fig. 2, showing a modified construction in which the holes in the top-plate are made broader at their outer ends than at their inner ends—*i.e.*, pear shaped in plan. The top-plate is, as usual, adapted to carry a central mantle holder or support; being provided with a vertical socket.

To "facilitate the mounting of incandescence mantles upon burners by unskilled persons, and to retain the mantle in proper position for use," the patentee proposes to adapt the perforated top-plate of the burner, by making it in the form of a cap, to be readily put on and removed from the top part of the burner-tube. To the central portion of the plate is fixed the lower end of the mantle support F, to the upper end of which the upper end of the mantle is securely fixed; the lower end fitting around the cap. By this means, the cap, mantle-support, and mantle form practically one article, that can be readily packed and "handled with much less liability of breaking the mantle or of setting it in an inefficient position on the burner-tube than has heretofore been usual." The lower end of the mantle-support may be fixed by suitable material (such as plaster of Paris, steatite, cement, or the like) in the centrally recessed socket carried by the top-plate; and the top part or cross piece of the mantle may be similarly fixed to the upper end of the mantle-support.

Gas-Burners.—Mills, B. J. B.; a communication from "La Société Anonyme des Fontaines à Gaz," of Fontaines-sur-Saône, France. No. 27,337; Dec. 27, 1898.

The burner forming the subject of this invention is intended to utilize, for illuminating purposes, gases of very variable composition or obtained under feeble pressure—such as "those arising from the distillation of wood, essences of petroleum, or special apparatuses such as the 'gas-fountains' patented by Bouchaud-Praceiq." The characteristic features of the burner are: (1) The large section of the channels which conduct the gas to the burner orifices. This section is in every case much larger than the total surface of the orifices, in order to occasion no loss of pressure of such gases as already have a very feeble pressure. (2) A very extended regulation of the air admission around the burner. This regulation may be made with precision from zero to the maximum quantity required by the different compositions of gases to be burned.

These conditions may be fulfilled by various arrangements, among which those which do not alter too much the appearance and dimensions of the ordinary burners are preferred, say the patentees. Such an example is shown in section and elevation.



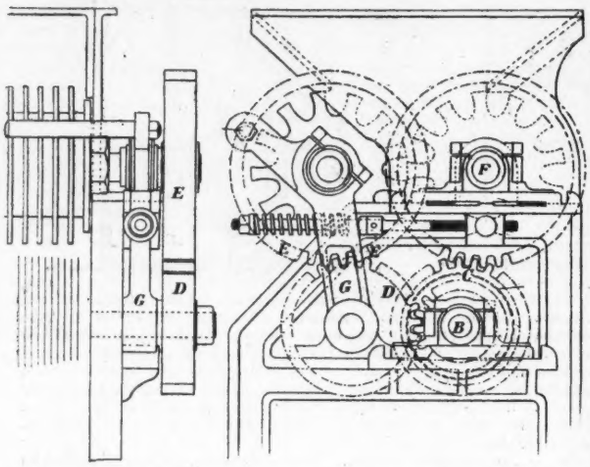
The burner is annular; the gas being conducted to it by a forked tube C preceded by a regulating-cock, the maximum opening of which and the section of the forked tube are much larger than the total section of the burner orifices, so as to be able to burn the gas with the full pressure of the generator or gasholder. The lower part of the burner is surrounded by a cylindrical sleeve B, closed at its lower part, and on the circumference of which are openings for the admission of air, which passes to

the burner through openings made in the upper part of the sleeve, and covered by the cone E reaching to the level of the burner. By this arrangement, the total air necessary for combustion passes through the former openings; and it suffices to close partially (or even entirely) these openings to regulate combustion. The closing is obtained by means of a ferrule G, of sufficient width, encircling the sleeve B, and capable of sliding on it so as to cover more or less the openings. In order to render the regulation invariable, the sleeve carries on its circumference helicoidal grooves H, in which engage the extremities of as many screws fixed to the ferrule G. It suffices therefore to turn this ferrule in one or the other direction to obtain a partial or an entire closing of the air-openings.

Coke-Breaking Machine.—Stevenson, S., of Lower Bland Street, S.E. No. 1013; Jan. 16, 1899.

This invention has for its principal object to enable the wear of the teeth of the cutters or breaking-rolls in coke-breakers to be taken up effectively.

An illustration is given of a half-front elevation of the machine, and a side or end elevation.



The framework A is surmounted by a hopper, and provided with a shaft B driven by a pulley, chain-wheel, or other convenient means. The shaft passes across the machine, and is furnished at one end with a pinion and at the other end with a spur-wheel C; the pinion gearing with an intermediate spur-wheel D secured in bearings to the side of the framework, and arranged to engage a wheel E. The wheel C engages a wheel driving the shaft F; and along the central portion of this latter is arranged a set of suitable cutters, by which a better result is said to be obtained than when breaking-rolls or crushers are used.

To the side-frames of the machine are pivoted and secured upright arms G, carrying a second shaft fitted with a set of cutters capable of meshing with, and intersecting, the first set; and these pivoted arms are provided with guides and locking means. The pivoted arms illustrated are approximately of Y-shape; the pivots being secured at the bottom of the figure, while the branches serve to carry the shaft of an adjustable roll, and a bracing stay or guard respectively.

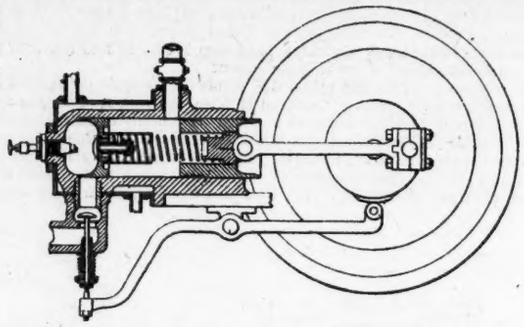
Each adjusting device consists of a rod furnished with a screw at each end, and arranged to pass through a boss about the centre of the pivoted arm G. One end of the rod engages with a nut secured to the framework of the breaker; the other or outer end being furnished with one or more nuts. Between the outer nut and the boss on the arm is a spiral spring; and a suitable collar is secured on the rod within the inner side of the arm. Each arm is thus provided with a safety spring to prevent the cutters being damaged. The adjustable side-arms can be instantly set to cut the coke to any size required; and this arrangement also takes up the wear of the cutters.

Producing Carburetted Air.—Mills, B. J. B.; a communication from "La Société Anonyme des Fontaines à Gaz," of Fontaines-sur-Saône, France. No. 1020; Jan. 16, 1899.

This invention is applicable to that class of apparatus called "gas-fountains" [see patent No. 27,337 of 1898, p. 1553], or to analogous apparatus, in which a current of air becomes charged with carburetted vapours by passing through a receiver containing matters which have absorbed carburetting liquids. Hitherto these absorbent materials consisted of a special wood cut into blocks of various shapes. But the inventors have discovered that paper pulp (wood, vegetable, or rag cellulose) used alone or agglomerated with various agglutinants—such as gum, dextrine, glucose, &c.—may constitute a kind of absorbent material superior to those already employed for the purpose. The pulp is soaked in water only, or in water containing agglutinant matters, and then moulded into pellets, which, on account of their spherical form, may be poured into the receiver without any precaution to assure the circulation of air—the form of the pellets favouring the passage of air through the receiver.

Explosion Engines.—Smith, F. H., of Dunblane, N.B. No. 1416; Jan. 20, 1899.

This invention relates to two-stroke-cycle engines having a supplementary piston to expel the products of combustion. The patentee interposes a spring between the two pistons (as shown), and provides a non-return valve preferably in the supplementary piston. On the explosion taking place, the two pistons are forced out together; but on opening the exhaust-valve at the inner end of the cylinder, the pressure is reduced, and the spring causes the return of the supplementary piston before the other, so as to expel the products of combustion. Meanwhile, the main piston has uncovered an inlet-passage in the outer end of the cylinder; and a charge of gas and air is admitted into the space between the



pistons. The return of the main piston compresses this charge, and forces it through the valve in the supplementary piston, into the combustion chamber.

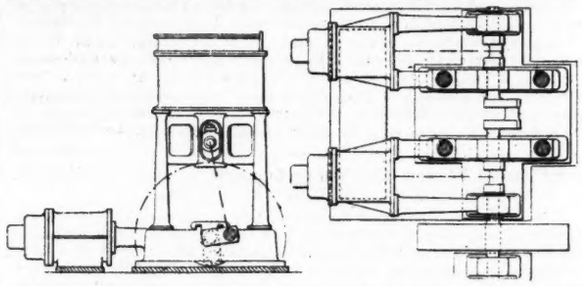
Gas-Producers.—Taylor, M., of Paris. No. 1574; Jan. 23, 1899.

The object of this invention is the construction of a gas-producer of small weight and without any scrubber requiring a current of water, and which will supply "richer gas than the ordinary poor-gas producers, and be easily regulated and kept in repair." The producer is mainly applicable for use in cases where a cleanly and simple installation, requiring little attendance, is desired; in particular "it will be found serviceable for auto-car, light locomotive, and like traction." It will, in this connection, feed a gas-engine drawing in gas direct by means of its working piston.

Combined Gas and Blowing Engines.—Thwaite, B. H., of Great George Street, S.W., Gardner, F. L., of Old Jewry, E.C., and Hartley, S., of Bingley. No. 2088; Jan. 30, 1899.

The waste gases of blast furnaces, when suitably purified, are sometimes utilized, the patentees point out, for working gas-motor engines; and this invention relates to the combination of such engines with blowing cylinders to provide blast for the furnace.

For this purpose, a twin gas-motor engine, having the cycles of its two cylinders arranged so that in every revolution one of the pistons performs its working stroke, has the cranks for the two pistons which coincide in their setting, or a separate crank connected to the piston of a single-acting blowing cylinder, in such a way that the early part of the working stroke of the engine corresponds with the latter part of the stroke of the blowing piston—as shown in the engraving. Thus the



gas-motor piston which is performing its working stroke has the greatest pressure acting on it when the resistance due to the greatest compression in the blowing cylinder has to be overcome. In order that the blowing piston may work at the speed of the gas-motor pistons, the suction and discharge valves for the air are worked positively from the engine-shaft, without the loss of time which occurs when they have to open and close automatically.

According to a modified arrangement, adapted to cases where there is a large supply of gas and a considerable volume of blast is required, two horizontal gas-engine cylinders are placed in line, one on each side of a common crank, to which both their pistons are connected; and there is placed vertically above the crank-shaft a pair of blowing cylinders, the one some distance above the other. The piston-rods of both the blowing cylinders are fixed to one cross-head, which works in guides in the space between the two cylinders, and has its end linked by connecting-rods to a pair of cranks on the shaft of the gas-engines.

Obtaining Cyanogen Combinations from Coal Gases.—Teichmann, H. of Rheinau, Baden, Germany. No. 12,485; June 15, 1899.

Cyanogen, the patentee remarks, is obtained from lighting gas almost exclusively by the so-called dry purification process, by means of oxide of iron; while no attempt has been made to obtain the cyanogen contained in coke and foundry gases, owing to dry purification not being practicable, in view of the enormous masses which would have to be treated in this respect.

The present invention has for its object the obtaining from coal gases—containing cyanide of ammonium, or the components hydrocyanic acid and ammonia, as well as greater portions of sulphide of hydrogen—the cyanogen, separate from the processes for obtaining ammonia and sulphur. The process is based on the observation that cyanide of ammonium, without the presence of a fixed alkali, acts energetically on freshly formed or precipitated sulphide of iron and sulphide of zinc, resulting in the production of cyanide of iron and cyanide of zinc respectively, and cyanide of ammonium, easily soluble in water, and sulphide of ammonium. If gases containing cyanide of ammonium are introduced into water which contains precipitates of sulphide of iron in suspension, the sulphide of iron is dissolved in proportion as cyanide of ammonium is

absorbed. The chemical process which takes place may be expressed as follows:—

$$FeS + 6\,NH_4CN = FeCN_2 + 4\,NH_4CN + (NH_4)_2S$$

By far the greatest part of the cyanogen, therefore, is contained in the solution; while a very small proportion of the cyanide of iron combination remains undissolved, besides undecomposed sulphide of iron. Sulphide of hydrogen and carbonic acid have no effect on the ferrocyanide of ammonium thus produced.

The patentee claims that the process offers a very simple and convenient means of obtaining from coke and foundry-coal gases, from which the ammonia has been extracted, cyanogen combinations, by interposing after the tar-separating and ammonia-absorption apparatus, another suitable absorption apparatus. Inasmuch as the alteration of the sulphide of iron takes place very rapidly, and the latter having little disposition to settle down, owing to which stopping of the apparatus does not take place, the scrubbers used in the process for obtaining ammonia can be employed. The "Standard" washer employed in lighting-gas manufacture can be used for this purpose with great advantage. In operations on a large scale, solutions of sulphate of iron are introduced into the washings; and these are immediately changed by the sulphide of hydrogen and ammonium into sulphide of iron and ammonium sulphate. The cyanide of ammonium contained in the gas now reacts on the sulphide of iron, producing ferrocyanide of ammonium, which passes into solution. When the greater part of the sulphide of iron has passed through the reaction, a further quantity of sulphide of iron or of sulphate of iron is added, by which means the percentage of ferrocyanide of ammonium in the solution is increased. The further treatment of the solution of ferrocyanide of ammonium for obtaining cyanide is exceedingly simple, inasmuch as, for instance, chloride of calcium can be added to the solution in order to precipitate insoluble ferrocyano-calcium ammonium. The precipitate, consisting of sulphide of iron and cyanide of iron, can be used for further absorption.

While the cyanogen is obtained in the form of ferro-cyanogen combinations when using iron salts, very valuable cyanogen combinations are obtained by employing zinc salts. Sulphide of zinc is changed by cyanide of ammonium, producing cyanide of zinc, cyanide of ammonium, and sulphide of ammonium. From the solution of the cyanogen, double salts cyanide of zinc can be obtained by the addition of further zinc salts, which cyanide then can be suitably transformed into cyanide of potassium.

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24,096.—Snell, C. S., "Burners for incandescent gas lighting." Dec. 4.
24,097.—Snell, C. S. & F. A., "Compressing gas." Dec. 4.
24,104.—Vollmann, C., "Self-acting gas-lighters." Dec. 4.
24,120.—Juhász, F., "Gas-lighters." Dec. 4.
24,124.—Wise, W. L., "Lighting and heating apparatus." A communication from A. Kitson. Dec. 4.
24,133.—Forbes, Sir C. S., "Burners for acetylene gas." Dec. 4.
24,192.—Chesley, S. A., "Fluid meters." Dec. 5.
24,203.—Posno, M., "Lighting and heating apparatus." Dec. 5.
24,261.—Dickinson, G. W., and Garlick, R. H., "Three-way connection for gas." Dec. 6.
24,265.—Sunderland, R. H. & F., and Marshall, G., "Acetylene gas-generators." Dec. 6.
24,302.—Sellar, W. C., "Washing gases." Dec. 6.
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24,337.—Maclaurin, R., "Heating and lighting." Dec. 7.
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24,356.—Metchin, D. B., "Lamp-lighter." Dec. 7.
24,360.—M'Ginn, J. St. L., "Gas apparatus." Dec. 7.
24,364.—Rouma, A., "Generating acetylene gas." Dec. 7.
24,383.—Chandler, S., jun., & J., and Kirkham, Hulett, and Chandler, "Washing and scrubbing gas." Dec. 7.
24,392.—Martini, A., "Gas ignition pills." Dec. 7.
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24,461.—Arnhold, H., "Pneumatically operated gas-taps." Dec. 8.
24,494.—Crossley, W. J., and Atkinson, J., "Combined gas motors and compressors or blowers." Dec. 9.
24,502.—Thomson, R., "Gas-producers." Dec. 9.
24,518.—Plaissetty, A. M., "Incandescent gas-mantles." Dec. 9.
21,572.—Weller, J., "Gas-motors." Dec. 11.
24,578.—Pease, E. L., and Ashmore, Benson, Pease, and Co., Ltd., "Gasholders." Dec. 11.
24,580.—Meynell, W., "Gas-pendants." Dec. 11.
24,598.—Knaeps, C., "Regulators for gas-burners." Dec. 11.
24,608.—Smith, R. H., "Gas-works governors." Dec. 11.
24,659.—Graham, M., "Hot coke conveyors." Dec. 12.
24,700.—Wylie, T. B., "Meters." Dec. 12.
24,731.—Clayton, T. A., "Charging closed compartments with gas." Dec. 12.
24,755.—Hindle, C., "Gas cooking and heating stoves." Dec. 12.
24,785.—Kirkcaldy, W., and Scott, W. C., "Lighting incandescent gas-burners." Dec. 13.
24,796.—Westrop, A., "Generation of acetylene gas." Dec. 13.
24,818.—Frank Wright's Prepayment Gas-Meter Corporation, Ltd., and Forster, J. D., "Lead seals for securing locks." Dec. 13.
24,825.—Denat, P., "Gas or oil engines." Dec. 13.
24,834.—Stauffert, L., "Manufacture of acetylene gas." Dec. 14.
24,876.—Thompson, W. P., "Manufacture of calcium carbide." A communication from P. P. H. Macé. Dec. 14.
24,906.—Green, W., "Anti-vibrator for street or other gas-lamp burners." Dec. 15.
24,991.—Kemp, C. W., "Chandeliers." Dec. 16.
25,009.—Boult, A. J., "Production of gas." A communication from A. Perrier. Dec. 16.
25,015.—Titchett, J., "Gas-stoves." Dec. 16.
25,024.—Kreiss, C. E., "Conveyors." Dec. 16.

CORRESPONDENCE.

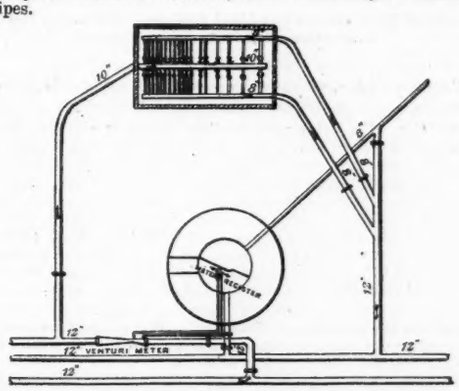
[*We are not responsible for the opinions expressed by correspondents.*]

The Consumption of Water per Head in Different Towns.

Sir,—The recent discussion in the "Journal" on the above subject has not been without interest. Some facts have been brought forward that will greatly benefit many of your readers.

The first correspondent, "Waste Inspector," took objection to the remark "that the Venturi measuring tube was an absolute necessity to the distributing engineer's department to base his calculations of the quantity of water consumed or wasted." I have not objected to the waste-water meter system, but, as previously stated, that the whole routine of the waste inspector's duty is exactly the same as that of the night inspector, who works without the use of the waste-water meter. Where these meters are used, it is still absolutely necessary that the output should be *accurately* ascertained, not by the rule-of-thumb, as some of your correspondents have explained. The waste-water meter does not show the exact house or houses where waste is taking place; so the whole district must be sounded in the same way as the night inspector is doing every night. In a town arranged, say, in six districts, as recommended by the waste-water meter advocates, we shall discover in each district a few slight defects at all times, with a good sensitive stethoscope. Therefore, if the night men are *continually* sounding all stopcocks, hydrants, and main cocks, they will detect every leak without the aid of costly waste-water meters, and far more economically. I have measured by the waste-water meter several districts after the night inspector has gone his round; but in no instance could I discover a leak that he had passed over with the stethoscope. As to placing the Venturi meter before the waste-water meter inspector, and regarding the Venturi as infallible, it is only necessary to state that the waste-water meter is not a check on the quantity of water said to be pumped; and unless the distribution department is credited with an absolute accurate quantity, the amount of waste, the rate per head per day, the efficiency of the pumps, and the usage at the pumping-stations, for sand-washing purposes, boiler cleaning, feeding, condensing, and all sundry purposes, cannot be ascertained. My experience proves that the work is not being conducted economically. The "infallibility" of the Venturi tube can now be verified in a great number of cases at home and abroad. I quoted this apparatus because it is the most handy, best adapted, and most economical for fixing in trunk mains. Many of these Venturi's are now fixed in the pumping mains. I also mentioned it because it is now being used as the standard measurer for most purposes.

The following sketch will show the utility and accuracy of the installation. Thirty-five meters of different sizes and description, and by different makers, were placed in the position as shown in the sketch, and as nearly as possible under the conditions in which the meters would be placed in service. The quantity of water was discharged into tanks on platform scales; and the difference registered by the Venturi and the mechanical meter was found to be 3 per cent. Two Venturi tubes were then placed on a main—tandem—to test the duty of the engines. The difference in the discharge, as indicated by the average head shown by the mercury gauge at each meter, was then found to be 0·68 of 1 per cent., which may be considered absolute, when measuring the discharge of large pipes.



This meter has been advocated by each of your correspondents. The East Jersey Water Company supply water through two 48-inch mains, with Venturi tubes fixed *en route*. The whole of the water is sold through eleven Venturi meters, varying in size from 12 inches to 48 inches. Some 40 million gallons per day pass through these meters; and the discrepancy between the total registration of the two recording meters and that of the eleven selling meters, is only 0·5 per cent. This proves the Venturi law to be absolutely reliable. The recorder is so adjusted that the meter can be tested *in situ* in a few minutes, and the record verified. This cannot be done with ordinary mechanical meters.

The remaining points raised by "Waste Inspector" have been well answered by "Another Inspector;" and I commend to him the article in the "Journal" for Sept. 12, on Self Help, &c. Cobden wrote that among waste inspectors might be found a great proportion of minds sufficiently enlightened by experience to concur in the opinion that it is to themselves *alone*, individually, that they, as well as every other great section of the community, must trust for working up, educating, and raising the level of their own craft.

"H. S. H." has contributed very useful and helpful notes, and has pointed out numerous causes of waste; the principal being the water-closet. The water-closet should always be supplied through a flushing cistern fed from the storage tank. My experience goes to prove that the 2-gallon flush is ample for all purposes, notwithstanding the model bye-laws issued by the Local Government Board, which say not less than 2 gallons, nor more than 4 gallons shall be used. The remaining valuable notes will be read with interest by water engineers. Model bye-laws

should be made by practical experts in water engineering. I have read in the "JOURNAL" of the Mayor of a large town discussing with the Water Engineer that the extension of the water-carriage system on the consumption of water would not increase the quantity of water used!

"Student" points out the cause of extraordinary consumption—viz., leaving the taps running to flush the drains. I cannot understand why the water companies do not impose a heavy penalty for such wilful waste, as well as for leaving the hose unattended, and running all night. There is no remedy but to fix a meter; the tenant paying for all water he uses over the minimum charge. Such waste is most dishonest, not only on the part of the tenant, but also on the part of the sanitary officer, who is constantly recommending plenty of water to be put down the drains. The sanitary inspector would not recommend such useless waste if water was paid for by meter. "Assistant" has replied to the other points in this letter very satisfactorily. I notice in two waterworks owned by corporations that the police are utilized as inspectors. They summon all parties using a hose or wasting water in any way. How would such proceedings be viewed if undertaken by companies? "Quod Potui Perfeci" has added much practical and valuable information to this discussion, showing that a uniform standard rate per head is unattainable. The local industries and circumstances vary considerably. These practical notes should be read by all water engineers.

It cannot be too often repeated that it is a fallacy to assert that such a quantity of water has been pumped when the amount is ascertained only by computing the quantity of water delivered, by multiplying the capacity of the pump-barrels by the number of strokes, and deducting a percentage therefrom for slip; no consideration being taken whether the engine is running slowly or at the normal speed. Such records will be found to be very inaccurate when compared with the automatic diagram taken from the Venturi measuring tube or the automatic level recorder. "Another Distributing Engineer" has shown clearly that the lowest, as well as the highest, consumption should be given, and a fair average for the whole year taken. There are always local circumstances affecting the consumption of water; and when there are a number of garden hoses at work, the question must be considered whether it is not the correct thing to meter all garden supplies—allowing the present usual rate as a minimum payment. Of course, that monstrosity the "automatic flusher" cannot be allowed to be fixed unless metered; and every meter should be protected by a back flap-valve. The first to initiate this mode of payment for garden hose were the municipal water-works of Croydon. Many towns, during the drought, prohibited the use of the hose altogether, and employed the police to report and summon defaulters. So long as companies are content to work without bye-laws and rules and regulations, with heavy penalties for breaking them, there must of necessity be great waste of water, uncontrollable by the inspector, and a source of considerable loss to the company.

Dec. 19, 1899. DISTRIBUTING ENGINEER.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, Dec. 19.

(*Before the* MASTER OF THE ROLLS *and Lord Justice* ROMER.)

The Welsbach Incandescent Gas-Light Company, Limited v. The Daylight Incandescent Mantle Company, Limited.

Judgment was delivered in the above case this morning.

Lord Justice ROMER, who gave judgment first, said: It is probable that the patentee might with safety have enlarged his claim, but he is bound by that claim. By it the patentee has, taking it shortly, claimed the manufacture, substantially as described, of an illuminant appliance consisting of a hood made of a fabric impregnated with the substances mentioned in the specification, and treated as therein set forth. So that there can be no infringement unless the alleged infringer has used those substances, or ingredients only colourably differing from, or substantially the same as, the substances mentioned. With reference to the phrase "ingredients substantially the same as the substances mentioned," I agree that the Court ought to take a broad view, and ought not to hold that ingredients substantially differ merely because they have different chemical names, or only differ in minor or comparatively unimportant respects from the substances mentioned. The plaintiffs' Counsel asked us to construe the specification as if the claim had been for the use of the substances mentioned, or any or either of them; so that, if a person used zirconia, either by itself or with any other oxide or matter, he would be an infringer, even though he did not use any of the other oxides or substances mentioned. In my opinion, looking at it fairly, the specification cannot be so construed. I agree that the invention patented was one of very great value and merit, and one which the Court should do its best to protect. But the Court ought not, in my view, on this ground, or because the patentee might have made a bolder claim, to put a forced or unfair construction on the specification; and, in my opinion, this specification does not, properly construed, cover a claim for the use of zirconia alone, or zirconia with some other matter, not being one—or substantially one—with the other substances mentioned in the specification. This being so, I proceed to consider what are the substances that the defendants are using. They use zirconia; but that in itself is not sufficient to constitute an infringement, as above pointed out. Substantially the only other substance they use is cerium, and that in an almost infinitesimal quantity—viz., ½ per cent. I now turn to the specification, to see whether this use of cerium with zirconia can be said, in any substantial or true sense, to be pointed out or covered by it, or whether it can be said in any true view to amount substantially to a use of the substances mentioned in the specification. In my opinion, it cannot. The only way in which cerium comes to be mentioned at all, is because it is a component of cerite earth. Cerite earth is mentioned as a substance which, under certain conditions, may be used; no doubt because it contains in substantial quantities oxide of lanthanum, which is a substance especially mentioned as one to be employed. When the specification is looked at, and the evidence is considered, it is clear that in substance the cerite earth is only to be used when one excludes from it all the didymium and all the cerium, except a little. Moreover, that little is only harmless if used with the other constituents of cerite earth except didymium. Cerium, in short, is only pointed out as a substance which is hurtful in large quantities, and harmless in small. That this is the correct view, is clear; although an opposite opinion appears to have prevailed in the Court below. Indeed, before us the learned and ingenious Counsel for the plaintiffs have not really ventured to contest, and could not properly contest, the correctness of the view I have taken, as above stated. So that we are asked to hold that a specification which does not venture to claim the use of zirconia by itself, and does not mention or refer to cerium as a matter to be used by itself with zirconia, and only refers to it as not being hurtful in small quantities in cerite earth, really covers the use of zirconia with ½ per cent. of cerium. It appears to me impossible so to hold, in accordance with any principle applicable to the construction of specifications. The fact is that no one at the date of the specification had the slightest idea that ½ per cent. of cerium, or any such quantity, would be of the slightest use, in itself or with zirconia, for the purpose of the patent. That it was of use was a remarkable and astonishing discovery of later time, and one not contemplated by the patentee or covered by his specification. In this context, it is important to bear in mind the proportions, given by the patentee in his specification, in which the substances must or should be used. I quite agree that in a patent of this kind the Court should not tie down the patentee too strictly to the proportions given by him; but in no fair way could it be said that the specification contemplated or covered the use of zirconia substantially by itself, or with only a wholly unsubstantial amount of some other substance added to it. In my opinion, therefore, in this case there has been no infringement. But it is said, on behalf of the plaintiffs, that we are prevented from coming to this conclusion because of the decision in the De Mare case. In my opinion, that is not so. In the De Mare case, the Court of Appeal had to deal with a case entirely different from this. Such a case as this was not before the Court of Appeal or in its contemplation. The distinction between such a case as this and the De Mare case was pointed out by Mr. Justice Wills in his decision in the action against the Sunlight Incandescent Gas Lamp Company.—a decision which the plaintiffs did not appeal from. On looking at the facts of the De Mare case, and the grounds of the decision there, they appear to me to leave it quite open to us to decide this case in accordance with its own merits, and what, in our opinion, is right. To state the matter shortly, what the Court of Appeal decided in the De Mare case was this: The Court pointed out that the oxide of lanthanum was mentioned in the specification as an element of the rare earths to be employed with zirconia, and that the oxide of yttrium was another; and that these two oxides could be used interchangeably, inasmuch as in the specification the latter oxide was described as one that could be used instead of a corresponding part of the other oxide. The Court further pointed out that the defendants were using erbium, which was practically yttrium, with zirconia; and they came therefore to the conclusion that the defendants were substantially—although not according to the letter—using the substances mentioned by the patentee in his specification. That decision, no doubt, went very far; but it would be straining it beyond what is fair and proper, to hold that in principle it decided the present case, which, as above pointed out, differs most materially from the De Mare case. In the present instance, in no substantial or proper sense can it be said that the defendants were using the compounds mentioned in, or pointed out to be covered by, the specification. In my opinion, therefore, the action should be dismissed with costs, here and below, including, of course, the costs of the issue as to infringement.

The MASTER OF THE ROLLS said: I have read that judgment, in which I concur, and do not intend to say anything by way of comment upon it. I may express my viewin a very few words. I think the case is a difficult one; but the difficulty arises from the tendency to confuse discovery and active invention. The conclusion at which I have arrived is that the defendants have largely availed themselves of Welsbach's discoveries; but they have not infringed his patented invention.

On the application of Mr. GRAHAM, the Court directed that a number of mantles which had been handed over to the plaintiffs by the defendants, in accordance with the judgment of the Court below, should be returned.

Grouping Houses for Water Supply.

At the Watford County Court, before Sir Alfred Marten, Q.C., Judge, a few days ago, the Rickmansworth and Uxbridge Valley Water Company sued Mr. W. H. Kennell, of The Firs, Harefield, for 48s. in respect of water supplied. Defendant contested the claim on a question of principle. Mr. S. Lynch, who appeared for the Company, said they were very anxious to take his Honour's ruling, as some 400 or 500 houses were affected, and the lead of defendant—he being a prominent man—was likely to be followed by others. Mr. Kennell was the owner of four cottages which were supplied with water through one pipe; and he claimed that he was only bound to pay for one supply, whereas the Company contended that he was liable for a separate supply to each house—making a difference as between 32s. and 48s. Evidence was given by Mr. J. D. Roper, the Manager of the Company, and the defendant, who stated that he applied to Mr. Roper to know the expense of laying the water on to these houses. When he found there were to be four separate connections, he declined point-blank to have the water laid on. Mr. Roper then, he said, made the offer of one service-pipe, and the houses to be considered as one occupation. He had always tendered payment on this basis. The statement as to an agreement was denied by the Manager. His Honour decided in favour of the Company, with costs.

Singular Water Supply Dispute.

The Wrexham Borough Magistrates were occupied a considerable time, at their sitting yesterday week, in adjudicating on a case in which a cashier (named Ellis) at the Llay Hall Colliery, and residing at Alyn Vale Cottage, Gwersyllt, charged the Brymbo Water Company with having cut off his water supply, and claimed the penalties provided for by law for such an act. Mr. Moss, M.P., who appeared for the complainant, stated that the complainant's water-rate was paid by the owner

(Mr. E. Stanley Clark) of the colliery. As long ago as 1893, there was unpleasantness between Mr. Clark and the Company; and it culminated in 1897 by the water being cut off from Mr. Clark's dwelling house. On May 19 the Company also cut off the water supply from the cottage occupied by the complainant, and it remained cut off until June 26. The consequence was that not only the health, but the very lives of the people occupying the cottage were jeopardized, because they had to get water for drinking and other purposes where they could, even from the River Alyn, which was certainly not a very safe supply. The Company were liable to a penalty not exceeding £5 a day for the period during which the water remained cut off. Every attempt had been made to settle the matter without taking proceedings, but without result. Mr. J. Hopley Pierce, who represented the Company, submitted that the only supply of water ever asked for on behalf of Mr. Clark, except for his private residence, was for trade purposes at his colliery. The act of Mr. Clark, therefore, in using the Company's water for the complainant's cottage did not justify the present action. The house in question was not supplied directly by the Company, but through a pipe connected with premises in the occupation of Mr. Clark, who was supplied by meter. It was further contended that the Company knew nothing of the existence of the house until after the water had been cut off; the fittings having been supplied by Mr. Clark. The rates due from Mr. Clark did not arise in respect of the property in question; and therefore the case was out of Court. The Magistrates dismissed the summons, without costs, on the ground that there was no supply to the complainant as occupier of the house, and that the water in the house was an undistinguishable part of the supply to the colliery. The Bench consented to state a case.

Disputed Consumption of Gas on the Prepayment System.

At the Worship Street Police Court last Wednesday, William Gilbert, a brush maker, of Hoxton, was summoned for not paying a sum of 3s. due for gas supplied by the Gaslight and Coke Company. Mr. Humphreys prosecuted. The defendant, it seemed, was supplied with gas by means of a penny-in-the-slot meter, and the allegation of the Company was that he had obtained gas which was registered by the meter, but for which pence were not found in the box. The defendant refused to pay what was claimed as the deficiency during three months—3s. With a considerable display of temper when in the witness-box, the defendant declared that not only had he not over-burned the gas, but had put pence in without getting gas. Mr. Humphreys called witnesses to prove that the meter, on the complaint of the defendant, had been two or three times changed; but the one in question was proved to be correct. It was, however, admitted that sometimes the consumer paid to the meter and the consumption was not shown; the extra payments being returned by the collector. The defendant alleged that this statement showed that the machines did not give gas even when pence were put in. Mr. Humphreys elicited that the gas might be running by the valve keeping open instead of automatically closing, and so the consumer obtained it without paying, though it was registered. Mr. Corser said the defendant had signed a contract to pay according to the meter register; and, whether right or wrong, he must pay the amount claimed.

Audacious Thefts from Gas-Meters by Boys.

An extraordinary story of boy burglary was told by Mr. T. B. R. Wilson at the Newport Police Court on Monday last week, when Frederick George Lee (16) and Howard M'Dougall (15) were charged with attempting to steal a padlock, a cash-box, and certain money from a gas-meter at No. 122, Durham Road, in that town. The Newport Gas Company, who appeared as prosecutors, were represented by Mr. Wilson and Mr. T. Canning, J.P., the Engineer and Manager. Mr. Wilson said the Company had no wish to be vindictive, or to press the charge unduly, but he was instructed to put before the Bench the fact that this charge did not stand alone. It happened to be the last of a long series of similar cases on which at length the Company had been able to put their fingers. When the boy Lee was arrested at midnight on the previous Saturday, he had in his possession a firearm capable of putting a bullet through a 1-inch board. A month ago, when he was warned, another weapon of the same character was taken from him. The lads appeared to have laid their schemes as carefully as burglars; and the total amount taken from the cash-boxes was very heavy—Lee having admitted five offences. He pointed out that the Magistrates were not dealing with the criminal class; the boys being the sons of parents of the highest respectability and good conduct. The work had been done in the dead of night. The boys had previously been cautioned in the presence of their parents. M'Dougall was an errand boy; and he marked the houses after the fashion of burglars. The boys first robbed, by the employment of false keys, the boxes in their own houses, and afterwards others. He was positively staggered, when the record of the cases was brought before him, at the systematic way in which the boys had worked. In reply to the Bench, Mr. Canning said the Company had adopted the latest patent in regard to the keys of these meters. Evidence as to the arrest of the lads having been given, the Bench decided to hear the other cases before announcing their decision. The accused were further charged with stealing 8s. from a gas-meter at No. 7, Clifton Place. Frederick George Lee and Charles James Bryant pleaded guilty to stealing 16s. from a meter at No. 20, London Street. The lads admitted the offences. Mr. W. L. Moore stated that Bryant (for whom he appeared) was admittedly not one of the worst of the gang to which his friend had alluded. He threw away the locks and destroyed the keys. The lad was apprenticed to an important firm in the town, and a conviction, he was afraid, would lead to his indentures being cancelled. He suggested that the Bench might deal with the defendants under the First Offenders' Act. For the sake of the lads, their parents, and their reputations, he asked them to adopt the course he had suggested. Mr. Wilson replied that he did not think Bryant was one of the leaders, but that he had been led. He (Mr. Wilson) was not instructed to be vindictive, but he called the attention of the Court to the fact that the offence was a very serious one. The Bench imposed a fine of 20s., or in default seven days, in respect to each charge. There were several other charges, which were not gone into

MISCELLANEOUS NEWS.

DESTRUCTIVE FIRE AT THE SHEFFIELD GAS-WORKS.

The Chemical Works at Grimesthorpe Ablaze.

At an early hour last Thursday morning, a fire broke out in the chemical Department of the Grimesthorpe works of the Sheffield United Gas Company. The flames were discovered by the watchman; and they were then just showing themselves in the north-eastern tower of the building. An immediate summons was given to the Fire Brigade, and within a couple of minutes the hose tender was on its way, followed by two steamers. As the distance to be covered was about three miles, the fire had obtained a firm hold by the time the first fireman arrived; and delay in getting a supply of water enabled the flames to make disastrous progress. The structure attacked, though only containing a single storey, is very high; and the tower where the flames were discovered rises about 70 feet from the ground. It was built entirely of wood, except the roof, which was covered with lead; and it contained in the large tanks the gas residual products and various other chemicals. These materials naturally aided the fire in its course; and, fanned by the breeze, it roared among the woodwork, and quickly converted the shop into a "burning fiery furnace." Immediately adjoining stood one of the gasholders—another abutting upon it; the total capacity of the two being about 3 million cubic feet. Fortunately the one nearest the fire was almost empty, and its companion not more than half full; moreover, the force of the wind tended to drive both flames and sparks in the opposite direction. It was from the tank of one of these holders that the firemen obtained water in sufficient quantity to enable them to cope with the fire. When they did get to work, they attacked the flames with vigour; and the volumes of water poured with practised skill upon the sources of the flames had the effect of subduing and eventually extinguishing them. The building had two towers, at opposite corners, and the one in which the fire started was subsequently burnt to the level of the surrounding block. The erection in question was used more particularly for the manufacture of sulphuric acid; and it blazed, if anything, more fiercely than the other parts. The destroyed building had been in use for some years; the latest addition having been made about thirteen years ago. The wood employed in its construction was tarred to make it acid-proof; and the chemical chambers were lined with lead. Such a fire had never previously happened at the works; and nothing has thrown any light on the origin of the conflagration. The damage is estimated at about £5000, which is to some extent covered by insurance. The offices adjoining the Chemical Department, which are built of stone, were entirely saved; and were not even damaged by water. Two other adjacent brick buildings, used for storing chemicals, were only slightly damaged. It is satisfactory to learn that, considering the great risk necessarily incurred in working among such dangerous materials as those which the building contained, there was no very serious mishap to the members of the Fire Brigade. The Company's Engineer (Mr. J. W. Morrison), the Manager (Mr. Hack), and several other officials, were in attendance at the works soon after the outbreak.

MANCHESTER CORPORATION GAS SUPPLY.

In an article entitled "Manchester Corporation Enterprise in 1899," the "Manchester Courier" of the 22nd inst. says: "There have been no special extensions of the plant for manufacturing gas at any of the works of the Gas Department during the past year. New appliances have been established at Gaythorn works. The re-arrangement of the Rochdale Road works has been proceeded with. A retort-house has been dispensed with, and the building altered and converted into a meter-house, governor house, mechanics' shop, and smithy. Two new station meters, of 170,000 cubic feet per hour each, have been fixed, and are at work, in substitution for four small and worn-out meters of much smaller capacity. The whole of the new pipes and connections required by these alterations both in and out of the works have been successfully and safely laid. Four of the old mains had been dealt with, and the remaining one was being blocked and partly removed in a similar manner when, on Oct. 30 there occurred the terrible explosion by which Mr. Stevenson, the Engineer, was killed and thirteen others were injured. At the Bradford Road works the chief event has been the erection of a circular coke-stacking plant, which will be useful either for stacking coke or loading it into carts. For the distribution of gas an independent 36-inch main has been laid, by which gas can be sent from any of the Corporation gas-works to any other of such works, by pressure or exhaustion; so that any abnormal demand for gas in a particular district can be easily met by contributions from various quarters. The increase in the consumption of gas since March 31 over that of last year is 143,371,000 cubic feet, or 5·73 per cent. The length of mains and services has been increased by 32,000 yards, or about 18 miles, making a total of 1110 miles. About 30,000 prepayment meters are fixed and working, showing an increase of 3250 since March 31; and there are at present in use 9322 gas cookers and fires, or about 2000 more than were in existence in March. In our review of the work of the department a year ago it was mentioned that there had been some attempt to promote discontent among the workmen. The question of work and wages has since been carefully considered by the Committee, with regard to the whole department; and, but for the untimely death of Mr. Stevenson it would possibly have been settled ere now. This and other points of importance will await final disposal until a new Engineer has been appointed. The total number of persons employed in the manufacture and distribution of gas and in the administration of the undertaking is 2200. The foregoing details have been obtained through the courtesy of Mr. Charles Nickson, the Superintendent of the Gas Department. From Mr. Nickson, too, we learn that since the incorporation of Manchester net profits of the Gas Department amounting in the aggregate to £2,346,470 10s. 2d. have been applied to the purposes of the Improvement, Water-Works, and Finance Committees respectively. The financial position of the Gas Department, as disclosed by the last balance-sheet (March 31, 1899), was as follows: Total value of works, property,

and other assets, £2,310,701 2s. 11d.; total liabilities (including the mortgage debt, £1,060,345), £1,242,517 17s. 1d.; excess of assets, £1,068,583 5s. 10d."

Numerous have been the complaints which have lately appeared in the Manchester papers as to the inadequacy of the gas supply of the city. The writer of one letter, dated the 15th inst., stated that for the previous month the pressure had been too low to supply the district in which his works are situated; and on the evening of the above-named day, the whole of the work was stopped—the supply of gas being insufficient to heat the kilns and soldering-irons. He went on to say: "This is a poor way of encouraging those who, like ourselves, are doing their best to lessen smoke by an intelligent use of gas for heating purposes. The same deficiency is strongly felt at West Didsbury, where I reside; and the use of a gas-cooker has been out of the question for a week or two. About three weeks since, the whole supply in the neighbourhood was reduced to a mere flicker at eleven o'clock at night, with the result that the gas, which was turned low in some of the rooms, went out. In a few seconds the supply was renewed; and had we retired to rest there would have been considerable danger of suffocation. The electric light supply is equally untrustworthy, and more than one business conference was to-day commenced under this illuminant, and concluded by candle light. Surely Manchester should do better than this." Another writer called attention to the inconvenience caused to users of gas-stoves for cooking and warming purposes by what he called the "wretched" supply of gas, which he characterized as unfair alike to the ratepayer, to the manufacturer of the appliances, and to the householder. A third correspondent began his letter by asking: "Is a foggy day an unheard-of event in Manchester?" He thought anyone would judge this to be so from the total absence of provision for such an emergency on the part of the Gas Committee of the Corporation. He proceeded in the following strain: "The people who have been compelled during the last week or so to conduct their business (to say nothing of pleasure) by the miserable apology for illumination provided by our Corporation are perhaps to be pitied; but they have this consolation—that they can at any time, by turning out their gas and lighting a farthing candle, produce a light which is, comparatively speaking, brilliant. But those who, like myself, are dependent on the gas supply not only for light but for power also, are in a far worse case. For them, a foggy day means a total stoppage of all machinery for three or four hours in the early morning and afternoon, involving a loss which may be imagined; and there is nothing to be done but to send the men home, shut up the place, and go down to have a chat with the officials in the Gas Office." He thought intending users of gas power would do well to consider before placing themselves at the mercy of a Corporation who, while showing commendable zeal in opening and collecting gas accounts, were unable to cope with the conditions of an ordinary winter's day.

ELECTRIC LIGHTING NOTES.

The evening services at several places of worship at Halifax were interfered with on Sunday, the 10th inst., by failure of the electric light; and gas and candles had to be resorted to. A few residences in King's Cross district were also deprived of their illuminant.

At the meeting of the Hastings Town Council on the 15th inst., it was resolved to reduce the price of the electric light from 8d. to 6d. per unit, *plus* 5s. per quarter meter-rent, from the 1st prox. Authority was given for making special terms with consumers using the lamps for more than two hours per day.

The recent failures of the electric light appear to have caused apprehension on the part of the Committee of the Guildhall School of Music that some mishap of this kind might interfere with the progress of the studies, for at a meeting a few days ago they had before them a resolution that candles should be used in the professors' rooms, to be available in case of emergency.

On Monday last week, owing to a mishap to the electric light apparatus, Portobello was plunged into darkness for about a couple of hours, and the results were rather disconcerting, as the breakdown occurred in the early part of the evening. Many of the shopkeepers have introduced this illuminant into their premises, and they had to resort to candles and wax tapers to give them the necessary light in the absence of the current. The greatest inconvenience was caused to business people.

Shortage of coal supplies has affected electric lighting undertakings throughout the country as well as gas-works, whether under company or municipal control. The Birmingham Electric Supply Company have, among others, experienced considerable difficulty in getting their requisite coal supplies, and a week or so ago approached the Corporation Gas Department with the object of obtaining relief by purchasing some from the city. The officials, however, in view of their own difficulty, were only able to furnish the Company with coke.

Last Tuesday, the memorial-stone of the offices and battery substation in connection with the new electric light works in course of erection in Pendleton, was laid by Mr. A. Haworth, the Chairman of the Electric Light Committee of the Salford Corporation. Mr. Haworth said the Corporation had entered on an undertaking the greatest of its kind in Great Britain. They intended putting down something like 10,000-horse power; and he believed the undertaking would prove a most profitable one to the ratepayers at large.

It is clear the municipal councillors of Sudbury, Suffolk, are becoming inordinately conceited as to what their little town is capable of standing in the way of expenditure, and as to that expenditure becoming productive of profit. With "every confidence" they decided last week to go forward with an electric lighting and refuse destruction scheme. What is the character of the base on which this extreme confidence reposes? It appears to consist mainly of a report presented to the Council by a small Committee, composed of the Mayor (Mr. F. Wheeler), Alderman C. E. Mauldon, Dr. King, and the Surveyor; and it deals principally with a visit paid by them to the electric lighting works at Harrow. If any one of these gentlemen has any particular qualification for inspecting and investigating an electric lighting works and its affairs, it is quite a recently-acquired accomplishment; and therefore the ratepayers should hesitate in being persuaded by them on such a matter as electrical supply without very full inquiry. Why did they choose Harrow for comparison with their own town? Harrow and Sudbury! There is only the remotest similarity between the two places, and that is in respect of its population. And even in this regard, Harrow stands superior to Sudbury by certainly nearly 2000 souls. It is true that Harrow is somewhat straggling; but Sudbury is not exactly what a sane man would describe as a compact town. The population are wealthier and altogether different in other respects; and the houses and colleges of Harrow have no compeers in Sudbury. Therefore it does not follow that even the modicum of success which has been achieved by the electric lighting works at Harrow will ever be secured by an installation in Sudbury. The Harrow works, the Sub-Committee have informed the Sudbury councillors, cost £25,000; and it appeared to them that about half this sum would be sufficient to put in a plant for the area proposed to be lighted in the borough, with something like £2000 added for the refuse destructor. It is believed by these electrical enthusiasts (as it has been temporarily believed by many others before them) that the latter will furnish one-half of the power necessary for generating the electricity; and even a better result than that is expected. But maybe experience will show them they have been slightly misinformed. The Sub-Committee also suggested that the electric current could be utilized for pumping in connection with the proposed sewerage works, which would "save the cost of erecting an expensive sewerage pumping station." It is not the initial cost, but the relative ultimate economy of this and other forms of power which should be studied by them. It is further suggested that electricity could also be adopted for driving the looms, &c., of weavers in their private houses. There are not, we fear, many weavers possessing such opulency as to afford a luxury of this kind.

To the accounts we have lately given of the failures of the electric light, the following illustration of its dangers may be appropriately added. It is contained in a letter from Mr. Montague Crackanthorpe (probably better known to many of our readers as Mr. Montague Cookson, Q.C.) which appeared in "The Times" last Tuesday: "One evening last week a fire broke out in this house with such apparent spontaneity, and in so novel a fashion, that some account of it may be both interesting and instructive. My wife and I were sitting in the drawing-room when we became aware of a smell of burning wood, and shortly afterwards perceived rings of blue smoke coming through the crevices of the boards close to the hearth and beyond the edge of the carpet. My first idea was that my neighbour's house was on fire, since I had quite recently left the room immediately below the drawing-room, where there was nothing amiss. Hurrying towards the door, I had just reached the middle of the room when, to my surprise, my foot passed right through the carpet and the floor into the hollow space underneath, which is consecrated to joists and other woodwork. Flames immediately issued from this space, somewhat in the style of the stage of a transpontine theatre when witches 'summon spirits from the vasty deep.' I then realized that the floor was ablaze, although owing to the smothering effect of the carpet, the flames were confined to the centre. With the help of cans of water and of the fire brigade, which arrived after a few minutes, the fire was arrested without much damage being done. Had the flames burst forth after the household had gone to bed, or had another foot than mine stepped through the floor, the consequences might have been very serious. To explain what had happened, it is necessary to mention one or two details. Two years ago the house was lighted by electricity throughout; the supply being taken from the mains of one of the local Electric Light Companies. From the 'rose' of the ceiling of the room below the drawing-room hangs a 32-candle power lamp, which is fed from an 18-gauge Silvertown wire. This wire (with two others of 16-gauge) is laid in the space above the ceiling, and is attached to two flexible cords, each consisting of 35 strands of very fine wire, and covered with silk in the usual manner. The attachment of the wires to the cord is made by twisting the first round the second, and soldering. By some unexplained mischance (for the fire destroyed all direct evidence of its own origin), these wires, or some of them, became partially stripped of their insulating coats, and so the current, instead of going through the lamp, found its way across what was at first a minute interval of air, but which, when the switch was on, was sufficient to set up a tiny arc light at that point. This arc light, the formation of which was probably assisted by oxidization of the exposed wire, had a tendency to increase in size, and at last it became so powerful that, after consuming the wooden casing in which the wires are laid, and still further injuring the insulating fabric, it started a short-circuit. This, of course, blew out the safety fuse, but not until the floor was well alight. The above theory is that of the electrical engineer who was responsible for the wiring, and also of the highly intelligent official from the Electrical Department of the London County Council, who, on the report of the fire brigade, called to inspect the premises. No question of overloading arose, as there was only one lamp on this particular circuit. Now, among the millions of miles of electric wire in the Metropolis, some defect of insulation, due to bad manufacture or to careless workmanship, is a thing to be expected; and I write, not to ventilate any grievance of my own, but to offer some practical hints to others. (1) If I were wiring my house afresh, I would have no encased wires under the floors, but would lead them along the ceilings and the insides of the rooms, so that they might be always in sight. If this had been done in the present instance, the arc light must have declared itself almost as soon as it was formed. (2) Instead of casing the wires in wood, as is the nearly universal practice, I would case them in asbestic plaster, or some other fire-resisting material. I cannot say, however, whether this plaster is or is not deliquescent. If it is, I would seek for something else which was at once non-conducting and fire and water proof. At the Russian Exhibition of 1896, a substance was, I believe, exhibited which claimed to possess all these three properties; but I do not know whether it is in the market or what its cost would be. (3) I would have the whole of my wires tested for leakage at least every twelve months, both by the earth test and the pole-to-pole test. If I had taken this precaution, the defective insulation (which, however slight at first, must have shown some deflection of the needle of a delicate galvanometer) might have been detected before the fire occurred; and the pole-to-pole test would have localized the fault. We are obliged by law to sweep our chimneys periodically. Why should we not also be obliged periodically to test our electric wires? One would imagine that the insurance companies would, in their own interest, insist on this testing as a condition of their policies. But, to be sure, if there were no fires there would be no fire insurers."

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of the Company was held at the Offices, Commercial Road, Pimlico, on Thursday last, under the presidency of Mr. F. S. Clayton.

The Secretary (Mr. G. H. Gill) read the advertisement calling the meeting, and subsequently the report of the Company's Auditors, who stated that they had great pleasure in again expressing their entire satisfaction with the clear and precise way in which the accounts had been kept.

The Governor then moved the adoption of the report. He stated that the business of the Company during the past half year—to September 30 last—had been fairly prosperous. The gross income amounted to £87,489, being an increase of £2383 over that of the corresponding period of last year; and the working expenses had been £26,093, or £957 more. The Directors were enabled to recommend a dividend of 11 per cent. per annum, the same as last half year, which would leave a balance of £3426, out of which £2000 had been carried to the contingency fund. The expenditure on capital account had amounted to £25,916, of which £24,365 represented payments to contractors on account of the new service reservoirs at Putney Heath, and for raising the banks of the subsidence reservoirs at West Molesey. These works were of considerable magnitude; and they were making fair progress. The Directors had reason to believe that both contracts would be carried out in the course of the coming spring; and when completed, the Company's Putney reservoirs' capacity would be duplicated. Instead of being 11 million gallons, as at present, there would be a capacity of 22 million gallons; and, by the banks of the West Molesey reservoirs being raised by 5 feet, they would have an additional capacity of 50 million gallons there. The quantity of water pumped from the Surbiton works to the district during the half year had been 2463 million gallons, or about 205 million gallons more than in the corresponding period of 1898. This was due in great measure to the drought of last summer; but, of course, it was partly due to the natural growth of the district for the purposes of water supply. The supplies laid on during the half year had been 388 in number, including new supplies by meter, &c.; and they were estimated to produce an additional water-rental of £1805. He must, however, mention that 277 houses had been pulled down for improvements—representing at the present time a loss of water-rental of £1024. A large portion of this was owing to the temporary loss (he supposed he must call it) of revenue caused by pulling down the houses in Parliament Street and Whitehall for the new public offices which were about to be erected. The Directors felt pretty confident that the Government would require a supply of water from the Company to serve these new buildings, although in candour he must say that it was doubtful whether the water-rental to be received therefrom would be very much in excess of, or even quite amount to, what the Company had lost. But in regard to the other houses that had been pulled down, the Directors expected that the Company would make a considerable profit in the water-rental to be received from the new houses which would take the place of the old buildings. The proprietors would easily understand that, in the early days of the Company, their increase of water-rental proceeded almost entirely from the development of the district; but in addition to this source of income, they now had another—the increased and improved water-rental by reason of old houses being pulled down, and being replaced by larger and more important buildings. About 45 or 50 years ago this branch of revenue really began in earnest. He might say that when Victoria Street, Westminster, was built, it was the largest improvement anywhere in the Company's district; and the ball had been rolling ever since, in increased force. It was only necessary for anyone to walk through Chelsea, to see the large increase that had taken place of late years in the number of improved houses and other residences, which had replaced small buildings of, perhaps, only one or two storeys; and the benefit which had accrued to the Company from this cause had been very large indeed. With respect to developments, he might mention that there were now only 400 acres of land undeveloped—not built upon—in the Company's district; and it was anticipated that in 15 or 20 years this would be covered with houses. When this happened, an increase in the revenue could only be looked forward to from the erection of new houses in place of old ones, and also from increased meter supplies for trade and other purposes. The Royal Commission on the London Water Supply had not yet presented their report. The Directors had reason to believe that it had been agreed upon, if not actually signed; but they knew nothing officially on the subject, nor, of course, did they know anything as to the views of the Commissioners. He should therefore abstain from making any remarks about it. The Bills introduced by the London County Council in the last session of Parliament to deal with the water supply of the Metropolis were either withdrawn or rejected. The Council had, however, given notice of their intention to re-introduce into Parliament in the coming session their Bills for the purchase of the Water Companies and the introduction of a supplementary supply of water from Wales. The Directors were of opinion that the County Council might very well have waited before taking this step, until the report of the Royal Commission had been issued. It was, however, useless to criticize the County Council. They had taken this step, the only effect of which would be, as far as the Directors could see, to put the ratepayers, as well as the Water Companies, to considerable expense in opposing them. The Companies, moreover, had to pay their share of the rates; and they were very large ratepayers. The Bill introduced by the Government last session to give effect to the recommendations contained in the interim report of the Royal Commission, imposing on the Metropolitan Water Companies the duty of making certain works and interchangeable connections between their several systems, in order to mutually assist one another in times of drought or emergency, became law in June last. There was no doubt that this measure was very beneficial. Before it was passed, certain works had been commenced and executed by some of the Companies, with the especial view of giving relief and assistance to the East London Company; and, as the proprietors would know, during the late severe drought the East London Company received material assistance in this way from other Companies. The water famine, which some of the unkind friends of the Companies had almost wished for, had therefore not arisen; everything having gone on in its normal course. Their Company, he need scarcely say, had suffered in no respect from the drought of last summer; they had had no difficulty whatever in giving a full supply to consumers. He reserved for the last the matter

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1545.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 13	10½	Alliance & Dublin 10 p. c.	21—22	..	4 15 5
100,000	10	"	7½	Do. 7 p. c.	14½—15½	..	4 16 9
800,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	Nov. 15	6	Bombay, Ltd.	5¾—6¼	..	4 8 11
40,000	5	"	6	Do. New, £4 paid	4—4½	..	5 6 8
880,000	Stk.	Aug. 16	12	Brentford Consolidated	273—278	..	4 6 4
270,000	"	"	9	Do. New	210—215	..	4 3 9
50,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	"	Dec. 14	4	Do. 4 p. c. Deb.	124—128*	..	3 2 6
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	250—260	..	4 8 6
226,320	"	"	8½	Do. A. Ord. Stk.	183—188	−2	4 10 5
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
420,000	20	Sept. 29	10	British	43½—44½	..	4 9 10
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	25—27	..	4 8 11
75,000	10	"	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Oct. 13	6	Buenos Ayres (New) Ltd.	9—9½	..	6 6 4
220,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	Sept. 29	8	Cape Town & Dis., Ltd.	13½—14½	..	5 10 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	56—58	..	5 3 5
550,000	Stk.	Oct. 13	13½	Commercial Old Stock	305—310	..	4 7 1
200,750	"	"	10½	Do. New do.	240—245	..	4 5 9
200,750	"	Dec. 14	4½	Do. 4½ p. c. Deb.	140—145*	..	3 2 1
800,000	Stk.	Dec. 14	9	Continental Union, Ltd.	177—181*	−1½	4 19 5
200,000	"	"	7	Do. 7 p. c. Pref.	178—183*	..	3 16 6
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	"	"	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	130—135	..	3 17 9
60,000	"	"	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	21—22	..	5 0 0
354,060	10	"	11	Do. £7 10s. paid	15½—16½	..	5 0 0
14,993,075	Stk.	Aug. 16	4%	Gas-light and Coke	4 p. c. Ord.	103—105	+1	4 13 4
					3½ p. c. max.	97—99	..	3 10 8
2,600,000	"	"	3½		4 p. c. Con. Pref.	119—122	..	3 5 7
3,799,735	"	"	4		3 p. c. Con. Deb.	96—98*	−2	3 1 3
3,993,975	"	Dec. 14	3	Hongkong & China, Ltd.		13½—14½	..	5 10 4
70,000	10	Nov. 15	8	Imperial Continental		213—218	−2	4 11 9
3,800,000	Stk.	Nov. 15	10	Do. 3½ p. c. Deb. Red.		101—104	..	3 7 4
473,600	Stk.	Aug. 16	3½	Malta & Medn., Ltd.		5—5⅛*	..	5 9 1
75,000	5	Dec. 14	6	Met. of	5 p. c. Deb.	110—114	..	4 7 9
560,000	100	Oct. 2	5	Melbourne and	4½ p. c. Deb.	107—109	..	4 2 7
250,000	100	"	4½	Monte Video, Ltd.		11—12	..	5 0 0
541,920	20	Nov. 15	3	Newc'tle & Gateah'd Con.		220—225	..	4 2 3
617,946	Stk.	Aug. 31	9½	Do. 3½ p. c. Deb.		106—109	..	3 4 8
264,855	Stk.	June 29	3½	Ottoman, Ltd.		5¼—5⅝	..	6 1 9
60,000	5	Sept. 29	7			*Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	Nov. 30	8	Oriental, Ltd.	7—7½	−¼	5 6 8
135,000	5	"	8	Do. New, £4 10s. pd.	6¼—6⅝	..	5 6 8
15,000	5	"	8	Do. do. 1879, £1 pd.	1¼—1½	..	4 11 5
500,000	100	Dec. 1	6	People's Gas 2nd Mtg. of Chicago Bonds	102—106	..	5 13 2
851,070	10	Oct. 13	7	River Plate Ord.	10¾—11¼	−¼	6 4 5
250,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	7 8 2
250,000	10	Sept. 15	10	San Paulo, Ltd.	12—13	..	7 13 10
135,000	Stk.	Sept. 15	10	Sheffield A.	247—249	..	4 0 4
209,053	"	"	10	Do. B.	247—249	..	4 0 4
447,427	"	"	10	Do. C.	247—249	..	4 0 4
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p.c. Ord.	132—135	−1	3 19 0
1,520,000	"	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c. and B. 2½ p.c.	141—143	..	4 3 11
250,520	"	"	4½		102—104	..	4 6 6
55,100	"	Dec. 14	4	Edmonton 4 p.c. Deb.	113—117*	..	3 8 5
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.	310—315	−3	3 9 10
150,000	"	"	5	Do. 5 p. c. Pref.	160—165	−3	3 0 7
160,000	"	"	4½	Do. 4½ p. c. Pref. '75	142—147	−3	3 1 3
175,785	"	Sept. 29	4½	Do. 4½ p. c. Deb.	148—153	−2	2 18 10
1,720,560	Stk.	Oct. 13	7	East London, Ord.	200—205	−2	3 8 4
654,740	"	June 29	4½	Do. 4½ p. c. Deb.	151—156	−1	2 17 8
890,000	"	"	3	Do. 3 p. c. Deb.	100—102	−1	2 18 10
700,000	50	Dec. 14	7½	Grand Junction 10 p. c. max.	107—109*	..	3 8 10
310,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	131—136	−2	2 18 10
708,000	Stk.	Aug. 16	14	Kent	348—353	−3	3 19 4
160,000	"	"	7	Do. New, 7 p. c. max.	200—210	..	3 6 8
1,043,800	100	June 29	10½	Lambeth, 10 p. c. max.	295—300	..	3 10 0
406,200	100	"	8	Do. 7½ p. c. max.	220—225	..	3 11 1
350,000	Stk.	Sept. 29	4	Do. 4 p. c. Deb.	125—128	−1½	2 18 0
500,000	100	Aug. 16	13½	New River, New Shares	428—433	..	3 2 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	133—138	..	2 18 0
902,300	Stk.	Dec. 14	7½	South-wark and Vaux-hall Ord.	203—208*	−2	3 12 1
126,500	100	"	7½		190—195*	..	3 16 11
489,200	Stk.	"	5	5 p. c. Pref.	160—165*	−2½	3 0 7
1,019,585	"	Oct. 13	4	4 p. c. A Deb.	131—136	..	2 18 10
1,155,066	Stk.	Dec. 14	10	West Middlesex	290—295*	..	3 7 9
200,000	"	"	4½	Do. 4½ p. c. Deb.	150—155*	..	2 18 1
200,000	"	Sept. 15	8	Do. 3 p. c. Deb.	101—103	..	2 18 3

referred to in the 14th paragraph of the Directors' report, relating to the absence of the signature and of the certificate of the Government Auditor to the accounts of the Company, not only for the past half year, but also for the previous one. It would appear as if there were "a little rift within the lute;" but he was happy to inform the proprietors that the Directors had received a communication from the Government Auditor, which led them to believe that this "little rift" would gradually fill up, and that the difficulty would be arranged. At the same time, it did seem rather strange, seeing that the Government Auditor took exception to the matter last May, that he should have kept them in doubt so long as to his intentions. The proprietors must not suppose for a moment that the Directors had felt any doubt as to their having a complete right to do everything that they had done. They had acted under the best possible advice that was obtainable; having consulted Mr. Cripps, Q C., and Mr. Cozens-Hardy, Q.C.—now one of the Judges of the High Court—whose opinions were unequivocally in the Directors' favour, and on whose advice the Board had unhesitatingly relied. They fully believed that the matter would now be arranged; and they thought that the Government Auditor had acted under an entire misconception of the facts of the case. This being the state of things, the Directors would, of course, drop the Bill referred to in the report. There would be no occasion for them to proceed with the measure, though it was annoying that the Company should have been put to this unnecessary preliminary expense.

The Deputy-Governor (Mr. Jackson Hunt), in seconding the motion, said the Governor had stated that when the 400 acres of land at Fulham were filled up, the Company would have to rely for an increase in their income upon an improved class of houses. He (the speaker) desired to add that by that time it might be hoped the Company would be at the end of their capital expenditure. No doubt, the Governor had had it in his mind to mention this point; but other important matters had caused him to overlook it.

The motion was carried unanimously, and resolutions were afterwards passed declaring the dividends recommended.

A Shareholder asked what reason the Government Auditor had given for not signing the accounts.

The Governor, in reply, said that, without giving any precise reason, the Government Auditor stated that he did not think the Directors were authorized to issue, in the way they had done, certain additional capital. He believed the Directors had put in their report the exact words used by the Government Auditor.

The Secretary stated that the Government Auditor said "he did not feel justified, without further advice, in accepting the action of the Directors as to the manner in which they issued the additional capital of £34,215 in March last."

Mr. Besley, Q.C., afterwards proposed a vote of thanks to the Governor and Directors, and congratulated them on having been able to present so very satisfactory a report. The reason given by the Government Auditor for not signing the accounts was quite unintelligible to him (the speaker) as a lawyer. Knowing something about the question of the Metropolis Water Supply, he thought he might state that the position of the Chelsea Company was a matter of envy to all the other Companies, in that their concern was in such a position as almost to defy the London County Council. He believed that, with the additions and works in hand, the Company would be in such a position that it would be impossible for them to be assailed by anyone.

Mr. John Drew, in seconding the motion, said he knew, from some acquaintance with the accounts, that the statements which had been made by the Directors could be fully justified. The Directors must be conscious that they would have to exercise great judgment in connection with what was going on. He believed that the report of the Royal Commission would very soon be issued; but meantime the contents were not known. They were all aware that the London County Council were still determined to introduce measures which would result in perplexing and vexatious proceedings; and these proceedings the Directors would have to meet. The proprietors were, however, fortunate in having a Governor and a Board of Directors who had shown their ability in the past to meet all emergencies.

The motion was carried unanimously.

The Governor, in reply, expressed great satisfaction at the confidence which was reposed in his colleagues and himself by the proprietors, who might rest assured that everything would be done to promote the interests of the Company, and to protect them againt all assailants.

The proceedings then terminated.

THE YEO VALLEY RESERVOIR OF THE BRISTOL WATER-WORKS.

The Secretary and General Manager of the Bristol Water-Works Company (Mr. Alfred J. Alexander) sends us a copy of the "Bristol Mercury" of recent date giving an account of the year's progress with the works at the new Yeo reservoir—now approaching completion. After referring to the complacency of Bristolians with regard to the water supply of the city, quickly as the population is spreading in all directions, as being quite natural when the experience of last summer's prolonged drought is considered, the article proceeds: It is not surprising, therefore, that little is heard among citizens of the huge undertaking of the Company in the delightfully picturesque Yeo Valley, where Nature has assisted the Engineer to make a reservoir, involving an expenditure of about £400,000, which will dispel any misgiving as to the city's water supply for the next half century at least, and probably longer, unless there is a perfectly phenomenal growth of the city. Where cattle may now be seen peacefully grazing, at a not very distant date will be a large lake, with a water area of 450 acres, the contribution of a watershed of about 5300 acres. Another significant indication of the capacity of the reservoir is the fact that it is estimated to contain when full about 1800 million gallons.

To come to details of the work, which Parliament authorized in the session 1888-9, we may mention that they consist of (*a*) the Yeo storage reservoir; (*b*) works for utilizing the Rickford spring and the necessary pipes

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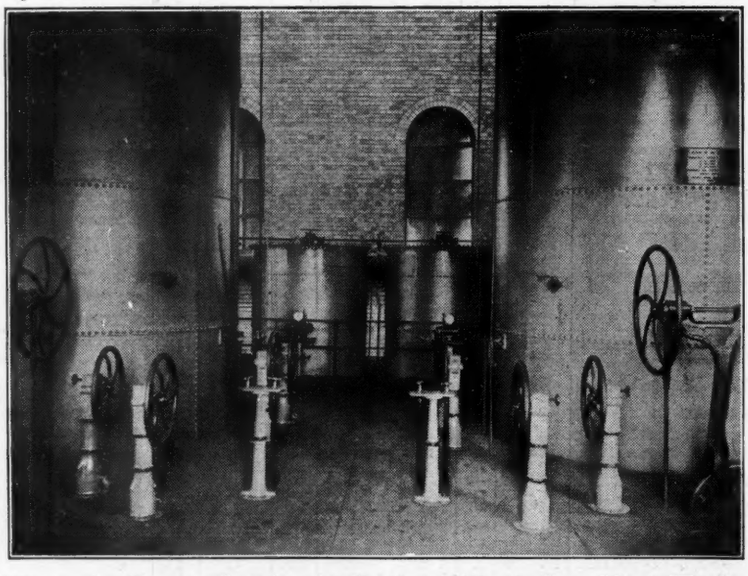

RESULTS PROVE EFFICIENCY.

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for conveying the water from this source to the Yeo reservoir; (*c*) works for utilizing the Langford spring and similar means of conveying the water therefrom to the Yeo works; (*d*) the pumping-station adjacent to the Yeo reservoir, by means of which the water will be pumped *viâ* the North Hill tunnel and pipe-lines to the Barrow reservoirs and filter-beds; and (*e*) drainage works. The reservoir is one of the six largest in Great Britain. The portion that is almost finished is the large and very substantial embankment which serves as a dam, and which at its highest point is 43 feet above the surface of the ground; but by means of a weir which has been constructed at the Butcombe side, the greatest depth of water is assured at 37 feet. As a supplementary outlet to this natural overflow, there are outlet-valves at the entrance to a brick tunnel, 10 feet in diameter, which will also feed the pumping-station on the other side of the embankment. In the construction of the 530 yards of embankment, a great public improvement has been effected, for a splendid wide roadway has been made across it, which not only replaces a narrow lane now within the area of the reservoir, but gives more direct access with a very slight gradient. The bye-wash for the purpose of discharging flood waters is a very substantial and important part of the work. It is 360 yards long, and 180 feet wide, and is all of masonry. It is chiefly of Cheddar and Tytherington stone pitching set in cement; and Forest of Dean stone has been largely used in the bridge over the bye-wash and in ornamental parts of the work. The weir-stones and the pitching of the inner slopes of the embankment are of Dartmoor granite. At the Rickford spring an ornamental gauge-house has been erected for measuring the water, which is conveyed to the reservoir by means of a 27-inch cast-iron pipe—the distance being about two miles. Similar arrangements have been made with regard to the Langford spring; the distance in this case to the reservoir being nearly 3¾ miles, with a pipe 21 inches in diameter. Adjoining the Yeo reservoir, engine and boiler houses are in course of erection for the reception of the machinery, by means of which the water will be pumped through cast-iron pipes to the existing North Hill tunnel of the Company, a distance of about five miles. The engines are of the compound rotative beam type. The installation comprises four engines with pumps complete, each capable of raising 2 million gallons a day (working 22 hours), a total capacity of 8 million gallons daily, or with three engines at work and one as a standby, 6 million gallons daily. There are six Lancashire boilers with mechanical stokers, fuel economizers, and other apparatus. The engine and boiler houses are being built of the best Shortwood and Cattybrook bricks, with stone dressings. An ornamental chimney, 130 feet high, is to be a feature in connection with the buildings.

It may be thought by the uninitiated that the work, when completed, will have been a long time in execution, especially as probably nearly two years more will have passed before it will be finished. The difficulties of such work are great, especially as they are hidden in the ground, to disclose themselves often unexpectedly and at inconvenient times. Moreover, as the nearest railway station, Sandford, is 6½ miles distant, the carriage of material by road has been a tedious business, though traction engines have been used. To resist such a vast volume of water behind it, it has been necessary to take the greatest precaution in the minutest details of constructing the dam; and owing to the nature of the soil, it has been found necessary to carry the puddle trench on which the embankment rests to a considerable depth, in order to secure a trustworthy foundation. Special apparatus has been constructed to provide compensation water for the river.

One of the features of the undertaking is the drainage scheme which had necessarily to be connected with it, in order to ensure as much purity as possible to the water. Four villages are involved in the scheme; and three systems have been devised to meet their requirements. All the sewage is to be treated on the septic tank principle. This work, undertaken by the Water Company, will deal effectively with the sewage of the villages; and the pure effluent water is to be discharged into the river some distance below the reservoir. This work, like that of the pumping-station, is far from complete—in fact, only just begun. In spite of this costly precaution against contamination, all the water from the Yeo Valley will be pumped into the storage reservoirs at Barrow, and pass through the filters there before it goes to Bristol for consumption. It will be a long time before any water from the new reservoir will be used, because though the land has been cleared of trees and hedges, and the contractor's engines are still busily engaged in traversing their undulating tracks with loads of "clearances" of various kinds, the ground has to be well scoured. Very shortly water will be allowed to accumulate in the reservoir for the purpose of destroying vegetable and animal life, and the scouring process will be continued until the works are complete, by which time it will, it is expected, be sufficiently pure to be utilized.

The Engineers of the scheme are Messrs. T. & C. Hawksley; and the work is the largest of the kind that they have undertaken, with the exception of the Vyrnwy reservoir. The Resident Engineers in charge of the works are Mr. J. E. Hannah and Mr. Dawson Kitchingham, for the reservoir works; and Mr. C. E. Robinson, for the drainage works.

Extensions at the Stafford Gas-Works.—Last Tuesday, Mr. E. P. Burd, one of the Inspectors of the Local Government Board, held an inquiry at the Shire Hall, Stafford, with respect to an application by the Corporation for a Provisional Order to amend the Stafford Corporation Act, 1876, so as to enable them to borrow money for the purposes of the gas undertaking. Only six persons were present, and four of them were officials. The money asked for is required for the following objects: Exhauster and buildings, £1500; station meter and buildings, £1250; station governor and buildings, £1000; coke-conveying plant, £2000; additions to No. 3 gasholder, £3000; stoking machinery, £3000; and water-gas plant, £8000. With respect to the last item, it was mentioned that it would postpone for a long time the erection of an additional gasholder, at a cost of £15,000. It was stated that the total amount borrowed on the gas-works was £107,583, and that by the end of next March £36,893 would have been repaid. When the Corporation acquired the works, twenty years ago, the price of gas averaged 4s. per 1000 cubic feet, and the output was 62½ millions. At present the average price is 2s. 6d., and the output 150 millions.

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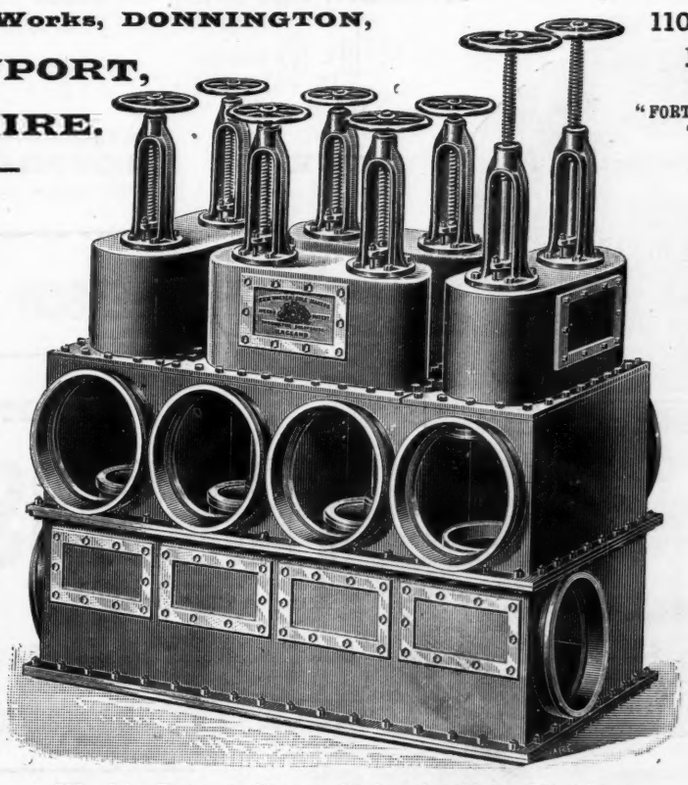

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I mentioned last week that no attempt had been made to reply to the letter which Mr. George Livesey published in the "Glasgow Herald" relative to the relationship of the Glasgow Corporation with their gas employees. Mr. Livesey is of too heavy calibre for them. But it is different when another person takes the field. There have appeared this week, also in the "Glasgow Herald," two letters, both signed "A Ratepayer;" and to the first of these Mr. Burgess, of the Gas Workers' Union, promptly wrote in reply, his answer being published on the same day as the second letter by the anonymous writer. In his first communication, the writer gave quotations from the rules of the Gas Workers' Union, and from Mr. Livesey's evidence before the Labour Commission; and he concluded with the passage: "An ounce of fact is worth a ton of sentiment; and the fact to be impressed on weak-kneed Town Councillors, who, in fear of the Trade Union vote, are willing to establish a Board of Conciliation jointly with the Gas Workers' Union, is that with the Union conciliation has proved an utter failure in practice. This, of course, is apart from what you have clearly laid down that a Joint Board of Conciliation is a third party, liable to improper influences, and that the Corporation of Glasgow can allow no third party to come between them and their servants." The second letter is mostly a narrative of what the Union has done. The conclusion the writer comes to is: "Whether any public body in a fiduciary position, as the custodian of the interests of an entire community, has any right to enter into relations with Trade Unions may be open to question. But there can be no question at all that any corporation which affords *locus standi* to the Gas Workers' and National Labourers' Union (which is not a Trade Union in the proper sense of the term), will be guilty of a grave breach of trust and dereliction of duty. For they will be placing at the mercy of a number of possibly reckless men, not merely the comfort and convenience, but also the property and lives of the citizens. It cannot be too strongly insisted that on no terms whatever ought the Corporation of Glasgow to entertain the petition of the Gas Workers' Union for a Joint Board of (so-called) Conciliation."

These are sensible remarks. I cannot say the same of the reply which Mr. Burgess sends. Referring to the "third party," he says: "The Corporation of Glasgow cannot override the common law. If a servant of the Corporation has a grievance, he can cite the Corporation to appear in Court; and he can employ a 'third party'—a solicitor or barrister—to appear for him. In English Coroners' Courts, a Trade Union Secretary may appear in the interests of the family of a fatally injured member. The same principle applies to grievances or disputes which are not of a legal or actionable character. Gentlemen learned in the law are frequently closeted, even in Glasgow, with Corporation heads of departments to represent the interests of clients far better able to protect themselves than labouring men of the gasworkers' class. It cannot be denied, therefore, that the Corporation workmen have a right in equity to choose a representative to speak on their behalf." Proceeding, he says: "Would Mr. Foulis not be a 'third party?' He is not the employer of the men; the men are in the employ of the Committee. But the Committee insist on Mr. Foulis being present. Why? That he may advise them. Is it necessary to say anything more to prove our case? If the Committee, all business men, all trained in public affairs, dare not take the responsibility of deciding a question of this character without first enjoying the benefit of the advice and experience of Mr. Foulis, how in justice can a similar privilege be denied to the workmen?"

In conclusion, he says: "Really, the Council have only a choice of alternatives. Either the Committees and the Council will be pestered with stories of grievances, all unsifted and unverified, or those grievances will have to be sent in the first instance to a joint body, whose business it will be to test all statements, and send nothing forward to the Council until it is in a fit state for presentation. It is the present system which affords an opening for the exercise of 'improper influences.' And, strange to say, it is those who complain that questions of hours and wages are introduced into election contests, who deny the workman any other means of redress. Corporations in other parts, where the Gas Workers' Union is better known, do not share the exaggerated fears evidenced in 'A Ratepayer's' letter. Officials of the Union meet in amicable negotiation week by week with heads of departments of the following administrative bodies: London County Council, West Ham Town Council, East Ham, Edmonton, Barking, and Walthamstow District Councils, Islington, Battersea, Walworth, Poplar, Bromley, and Lambeth Vestries. These are all in the London area, where the Union has been the longest established, and its principles are best known. We do not hear, however, that the social revolution has been inaugurated in consequence of this recognition. In the Provinces, the Union is recognized by the Town Councils of the following towns and cities: Leeds, Sunderland, Middlesbrough, Darlington, Stockton, Manchester, Bury, Wigan, Darwen, Stockport, Glossop, Colne, Blackburn, Oldham, Rochdale, Heywood, Macclesfield, Middleton, and Llanelly. Practically, the Union is recognized in all the centres where it is established. The National Labour Union is also recognized by the Town Councils of Newcastle, Gateshead, South Shields, Tynemouth, Sheffield, and Belfast, and by the Hebburn Urban District Council, the Wallsend District Council, and the Battersea Vestry. What has been conceded with nothing but beneficial effects in all these places will surely not be refused in Progressive Glasgow; and, strong in that assurance, we await with equanimity the result of the discussion in the Town Council on Thursday first."

Readers will observe that, in this portentous list of plans where the Union has obtained the ascendancy, it is not said that the Gas Department is involved. Take, for instance, Sunderland. Gas is there supplied by a Company; and it is the Town Council who are said to have accepted conciliation. There may be other cases. I point this out because, with a casual reader, it might be assumed that the gas-works in all the places named are in the clutches of the Gas Workers' Union. I have only time to notice one argument of Mr. Burgess—that in which he speaks of Mr. Foulis as a "third party." Mr. Foulis is the servant of the Corporation; and when a workman, or deputation of workmen, appear before the

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Corporation, they are in the same plane with him, so far as legal status goes. In authority, and in municipal status, he is their chief; and his word is entitled to more weight than theirs. But if the men choose to make a representation to the Corporation, they there meet Mr. Foulis, as a fellow servant, who has his say in the matter just as they have. As a matter of fact, all business with the men should be transacted by Mr. Foulis. As I said last week, it is not proper to go past him to the Corporation; though it is sometimes done, and may be tolerated occasionally, which is a different matter from arranging for habitual negotiation. It is, therefore, in reality the Corporation who are the "third party."

The Edinburgh and Leith Gas Commission held their monthly meeting on Monday—a week earlier than usual, because of the holidays. They had little business to transact. Mr. Kinloch Anderson made a statement regarding the demand for gas, which shows a very satisfactory state of matters; and he also gave the reason for it. He said that from May 16 to Nov. 14, there had been an increase in the output of gas by 44,046,000 cubic feet over the corresponding period of last year. Dealing with the week from the 11th to the 17th inst., he said the increase had been quite abnormal; having been nearly 6 million feet, equal to 15·69 per cent. The week was a very dark one. The abnormal demand taxed the Engineer to his fullest energy, to meet the output. He pulled through; but the sooner the new works were in working order, and able to supply the large quantity of gas which was now required, the better it would be in the interests of the consumers, as well as of the Commission. The works were being proceeded with as fast as possible; but he was sorry to say that some of the contractors were not up to time.

From the minutes which were submitted, it appeared that the Engineer (Mr. W. R. Herring) is proceeding to open up a freestone quarry in a corner of the site of the Granton works; also that it has been resolved that, as far as practicable, the retort-house and coal-store buildings shall be erected of brick. It having been found impracticable to procure Craigleith (Edinburgh) freestone for the coping of the tank of the new gasholder, it has been arranged to allow the Contractor (Mr. Wilson) to substitute for it Belgian limestone, of a quality eminently suitable for the purpose, at an increased cost of 1s. 6d. per cubic foot.

At a recent meeting of the Special Sub-Committee as to the proposed purchase of the site of the old Pollokshaws Gas-Works, Glasgow, the Committee, with the representatives of the Corporation Tramways Committee, met in conference with a deputation from the Commissioners of the burgh of Pollokshaws with reference to the proposal by the latter to acquire from the Corporation the site of the old gas-works for the purpose of carrying out certain street and other improvements within the burgh. The ground forming the site extends to about 3784 square yards. After an interchange of views between the parties, the following arrangement was agreed to, subject to the approval of the Corporation of Glasgow and the Burgh Commissioners: (1) That the Corporation should sell to the Commissioners the site of the gas-works, at the price of 6s. 8d. per square yard; (2) that the Corporation should have the option of purchasing from Mr. John Campbell the portion of the lands of Printfield shown in the plans submitted, containing 12,034 square yards or thereby, at the price of 3s. 4d. per square yard, upon the understanding that there are no feu duties or other burdens affecting the same; (3) that the buildings, gasholders, and other erections upon the site shall belong to, and be removed by, the Corporation; (4) that, if and when required by the Corporation, the Burgh Commissioners and Mr. Campbell will, so far as they can, assist the Corporation in obtaining the powers or consents which may be necessary to enable the Corporation to use the 12,034 square yards of ground, or any portion thereof, for the purpose of constructing and maintaining gasholders thereon; (5) that the street improvements shown upon the plan submitted, or other town improvements equally desirable, will be carried out by the Commissioners; (6) that both pieces of ground will be re-measured, so that the exact contents may be ascertained; and (7) that the whole expenses connected with the deeds necessary for carrying out the sale of both portions of ground before referred to will be borne by the parties interested in equal proportions.

The Corporation of Aberdeen have acquired the tramway undertaking in the city; and, like some other misguided bodies, they have introduced the trolley-wire system of electrical traction. The inauguration of the system is about to take place. It is to be presumed that the particular Committee of the Corporation who are responsible for the new departure have thoroughly considered the subject; but it is open to question whether they have looked at it all round. The effect upon other departments of their working has probably not been taken into account. The following extract from an Aberdeen newspaper shows how skilfully they manage to go about their business. It will be observed that electrolysis is not once mentioned: "In connection with the proposed new tramway lines, and the reconstruction of existing lines for electric traction, the Burgh Surveyor reports that it will be necessary to make considerable alteration on the water-mains along certain routes. In some cases, the water-mains would be directly underneath the line of the tramway as proposed to be constructed; and, in others, the house connections would require to be laid across the street under the entire width of the tramway track. In order to obviate the inconvenience and expense which this arrangement would lead to, it will be necessary to lay new mains—in most cases one on each side of the track, and entirely clear of the rails. As the work will take some time to carry out, and as it is desirable that the tracks should have some time to consolidate before the street is put into a proper state of repair, it is recommended that the work be put in hand without delay. The Water Committee approve of the report, and recommend that the works—which will cost £2000—should be at once proceeded with."

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 22.

Sulphate of Ammonia.—The market has been very quiet all through the week, and prices have drooped further, the closing quotations being £11 to £11 3s. 9d. per ton, delivered f.o.b. at the ports. The absence of business in the forward position continues to react upon the spot market, and buyers are again postponing their purchasing as far as possible; so

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that the output is only being disposed of at declining prices. For delivery over the spring months, and up to June, the quotation is nominally £11 10s. per ton f.o.b.

Nitrate of Soda remains firm at 8s. per cwt. for good, and 8s. 1½d. for refined quality, on spot.

LONDON, *Dec.* 22.

Tar Products.—Benzols are flat; but makers are well sold, and are not responding to the "bearing" that is taking place by middlemen. A fair business is noted in naphthalene. Carbolic acid is not quite so strong. There are little or no stocks; and what business is being done is more or less of a speculative character. It is not likely to see lower prices, although in some quarters the article is being decried. Creosote and oil show a steady consumption. Crude naphthalene is firm, with inquiries for special qualities to strict specification. Anthracene is held, and its value is steady. For pitch, there is renewed inquiry; but manufacturers are well contracted in the meantime.

The average week's values are: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast, 33s. 6d.; west coast, 31s. Benzol, 90's, 8d.; 50's, 10½d. Toluol, 90 per cent., 1s. 3½d.; pure, 2s. 1½d. Solvent naphtha, 1s. 4d.; crude, 30 per cent., naphtha, 5d.; heavy naphtha, 1s. 3½d. Creosote, 3½d. Heavy oils, 65s. Carbolic acid, 50's, 2s. 6d.; 60's, 2s. 9d. Crude naphthalene, 52s. 6d. Anthracene, "A," 4d.; "B," 2½d.

Sulphate of Ammonia is somewhat depressed, and buyers have been holding aloof expecting lower prices; but as the week closes there is again a return of inquiries, particularly for forward delivery. For spot, makers are asking £11 to £11 5s., less 3½ per cent.; and for spring delivery, £11 10s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—What with rumours of a possible advance in prices, and alarmist statements in the daily press as to the probability of a coal famine, coupled with the usual anxiety to get in extra supplies before the holiday stoppages of pits, there has been a somewhat exciting pressure of business during the past week; while, on top of this, the railway companies are quite unable to deal with the traffic, and there are the most serious delays in transit over the local lines from the pits to the points of delivery. Under these conditions, it can be well understood a situation has been brought about which is anything but satisfactory, either to the coalowner or the consumer. On the one hand, deliveries to customers are only being made with the greatest possible difficulty; and in some instances partial stoppages of works have been caused by coal supplies not coming forward. On the other hand, buyers in the open market have to pay special prices to obtain deliveries before the close of the year; and for the moment ordinary list quotations are scarcely more than nominal. For house-fire coal, list rates are unchanged; but prices are exceedingly stiff at about 13s. 10d. per ton for best Wigan Arley, 12s.6d. for Pemberton four feet and seconds Arley, and 11s. for common house coal at the pit-mouth. For steam and forge coal, however, it would be difficult to place orders just at present under about 10s. 6d.; while for ordinary qualities of engine fuel as much as 9s. 6d. to 10s. is being obtained on prompt sales. For shipment, steam coal has been fetching 12s. 6d. to 13s. per ton, delivered at the ports. Although it is still doubtful whether there will be any general upward move in prices, beyond, perhaps, a stiffening up in slack in the Manchester district, to the advance of 1s. 8d. already put on in West Lancashire, representatives of collieries are all refusing to quote for contracts except at 10d. to 1s. 3d. per ton above the current rates. A meeting of the Lancashire Coke Makers Association is to be held this week for the purpose of considering prices; and as it is certain list rates will be put up quite 2s. per ton, further orders or contracts are only being entertained subject to advances of 2s. to 2s. 6d. over present current rates, which are simply nominal.

Northern Coal Trade.—There is a strong demand for coals; and though the passing of the frost has allowed supplies to be more readily brought forward, they are still inadequate to meet all the needs. In the steam coal trade, some 50,000 tons of best Northumbrian coals have been delivered for prompt shipment for governmental purposes; and thus prices are rather higher than they were—about 14s. 6d. per ton f.o.b. being the general quotation. For second-class steam, 13s. 6d. per ton f.o.b. is quoted; and for steam smalls, 8s. to 8s. 3d. In the gas coal trade, the chief collieries are pressed with orders; and as the deliveries on contract are at the highest point, there is very little coal free for sale. Prices are thus difficult to quote; but probably 15s. to 15s. 6d. per ton f.o.b. will represent the values that are usually asked for any coal that can be supplied comparatively early. For coal under contract, it is to be remembered that the prices next year will be higher on the average; but in the course of a few weeks there will be some reduction of the general demand, as in places this is the period of fullest use of gas coals. Gas coke is in strong enough demand to take up the larger output; and the price is maintained, though it is unequal, at perhaps 14s. 6d. per ton f.o.b.

Scotch Coal Trade.—Coal is getting scarce, on account of the extra demand by manufacturers who are laying in stores to enable them to tide over the holidays. Prices are accordingly still rising. Cold weather has led to a large demand for coal for household purposes, and such sorts have been raised by 1s. per ton. The prices quoted are: Main 10s. 6d. to 10s. 9d. per ton, f.o.b. Glasgow, ell 12s. 3d. to 13s., splint 12s. 6d. to 12s. 9d. The shipments for the week amounted to 182,103 tons—a decrease of 8877 tons upon the previous week, but an increase of 27,752 tons upon the corresponding week of last year. For the year to date, the total shipments have been 8,599,409 tons—a decrease of 753,091 tons upon the same period of last year.

Messrs. Meldrum Bros, of Atlantic Works, Manchester, have opened offices at 2, Prince's Mansions, Victoria Street, Westminster. They have lately added to their specialities a "Koker" stoker—a combination of mechanical stoking with their forced draught, for securing a smokeless chimney, and at the same time giving high fuel and boiler efficiency.

RICHMOND & CO., Ltd.

London, Warrington, Stratford, &c.

The Lighting of Hillesley by Acetylene.—For some weeks past, much interest has been taken in the progress of the work in connection with the installation of an acetylene-gas plant for the purpose of illuminating the thoroughfares of the village of Hillesley (Wotton-under-Edge). There are 16 lamps, placed so as to give the greatest amount of light to the somewhat winding and diverging roads. The entire cost of the installation has been borne by the Rev. E. J. F. Johnson, the popular Vicar of the parish, whose generosity is highly appreciated by the inhabitants, who have presented him with an illuminated address. The ceremony of lighting the first lamp was performed by the youngest daughter of the donor, Miss Aline Johnson, on the evening of the 11th inst.

The Lighting of Singapore.—We learn from Singapore papers for the 23rd ult. recently to hand that the lighting question, which has been for some little time under consideration in that city, has been settled. At the meeting of the Municipal Commission on the 22nd ult., the minutes presented by the Lighting Committee set forth, among other things, that a letter had been received from the Manager of the Gas Company (Mr. Albert Ford) stating that the Company were willing to extend the existing gas contract for two years, and that a meeting of the shareholders would be held on the 29th to again consider the price. The President (Mr. Gentle) proposed—"That, in reply to his letter, the Manager of the Gas Company be requested to inform the Directors that the Commissioners accept the offer of the Company to extend the contract for street lighting, and the lighting of municipal buildings, for two years, 1900-1901, at the present rates and conditions, and await the intimation of the revised sale price of the plant and business to be declared after the shareholders' meeting." Mr. Manson seconded the motion; and it was carried unanimously. In view of the acceptance of the Company's offer, it was also decided to suspend the alteration of the gas-lamps to render them suitable for oil lighting.

The Duration of Scottish Coalfields.—At a recent meeting of the Mining Institute of Scotland, Mr. R. W. Dron presented a contribution on "The Probable Duration of the Scottish Coalfields." He showed that from 1854 to the present date the output of coal from Scotland had represented, on an average, 13·3 per cent. of the output of the United Kingdom. He gave this estimate on the assumption that the Scottish output had always maintained the same ratio to that of the United Kingdom. On these figures, he estimated the total amount of coal worked in Scotland up to the present time as 1504 million tons. By calculations, he had arrived at the estimate that 10,121 million tons of coal were still available; and, by carefully noting the amount of home consumption and export trade, he had reached the conclusion that all the proven coal in Scotland would be exhausted by the year 1989, and the reserve coal by 2080. In a comparison of the outputs of the various counties, Mr. Dron said that of Lanarkshire and Stirlingshire was nearly double what it was in 1878; whereas the output of Ayrshire in 1898 was only 500,000 tons more than it was in 1878. The output of Fifeshire, on the other hand, was now almost three times as great as it was in 1878—a remarkable contrast to the stagnation that was so long experienced in the Lothians and Ayrshire.

Suffocated by Gas Fumes.—A chemist's assistant, named Read, living at Brixton, was asphyxiated by gas fumes emanating from a gas-heating bath-geyser last Saturday week. At the inquest, Mrs. Read stated that her son turned the gas full on at the meter, and went into the bathroom to prepare for the theatre. He was in the best of health and spirits; but half an hour later water was seen flowing under the bathroom door, which was thereupon forced. The bath was overflowing, and her son was dead. The room was filled with suffocating gas fumes from the hot-water geyser, which was an old-fashioned one, though it had been repaired.

Bradford Corporation Bill.—A statutory meeting of Bradford ratepayers was held yesterday week at the Town Hall, for the purpose of assenting to the promotion by the Corporation of a Bill in Parliament giving power to purchase the undertakings of certain Gas Companies, and for various other purposes. There was, as usual on such occasions, a very small attendance of the public. The Mayor said that the meeting was called for the mere formality of giving assent to a Bill which had already been approved by the Town Council. He moved a resolution assenting to the Bill. The Town Clerk (Mr. F. Stevens) presented the full list of the provisions of the Bill. No remark was offered by any person; and the resolution was adopted unanimously.

Inclined Retorts at the Ilford Gas-Works.—In order to meet the continually increasing consumption at Ilford, considerable extensions of the Gas Company's plant are being arranged for; among them being a new retort-house prepared to receive twelve arches, each to contain settings of eight 20-feet sloping retorts. Tenders were recently advertised for six arches complete, with all modern appliances, together with retort-house and coal-store roofs; and the contract for the whole of the work has been let to Messrs. R. Dempster and Sons, Limited, of Elland. The furnaces are to be of the same type as those heating the inclined-retort installation at Chesterfield, which was erected by the firm. The plans and specifications have been prepared by the Gas Company's Engineer, Mr. J. H. Brown, under whose supervision the work will be carried out.

Water Supply for a Cheshire Township.—Last Friday week, Mr. W. A. Ducat, one of the Local Government Board Inspectors, held an inquiry at Wimboldsley, respecting an application by the Northwich District Council for sanction to borrow £2100 for works of water supply for the first-named place. The estimated required supply was stated to be 6255 gallons per day. The Council's scheme is to acquire some underground springs, the minimum supply from which has been proved to be 22,500 gallons per day. The Council also propose to enter into an agreement with the owner, so as to use a mill-wheel in close proximity for pumping power. A reservoir capable of holding 13,000 gallons and a service-tank and tower are also included in the scheme, the carrying out of which will entail on the township a 6½d. rate in addition to the water charges. The Clerk to the Council (Mr. A. Fletcher) showed that the scheme had been promoted in consequence of a memorial from the various farmers and residents in Wimboldsley, who were apparently willing to contribute to the annual deficiency.

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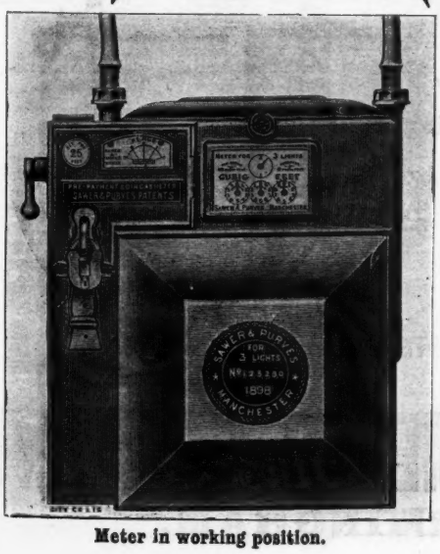

Meter in working position.

Meter with attachment removed without uncoupling.

Gas Workers' Wages at Hinckley.—The employees at the Hinckley Gas-Works have asked the Urban District Council to concede the following alterations in the rate of wages and conditions of work: (1) That stokers' wages be increased to 5s. per day. (2) That the coal be wheeled into the retort-house, and that the coke be taken away with them. (3) That time-and-a-half be paid for all Sunday labour. The matter is under the consideration of the Gas Committee.

The Gas and Allied Trades Exhibition.—This exhibition, to which several references have been made in the "JOURNAL," was opened last Thursday. There are in all about fifty exhibitors; and the exhibits will occupy the spaces in the area east and west of the stage, and also the north and south galleries. The stalls were not all complete at the opening, and therefore fuller notice of the exhibition must be held over till next week. Judging from what was on view, the display of incandescent gas-lighting will be very brilliant. A feature of the exhibition is the delivery of cookery lectures.

The Huddersfield Corporation and the Water Engineers' Association.—At the meeting of the Huddersfield Town Council last Wednesday, the Water-Works Committee reported that they had had before them a circular from the British Association of Water-Works Engineers in which it was urged to be essential to the public interest that the water supply of the United Kingdom should be subject to the general control and supervision of some independent, authorized, and properly-justified body or department. The Committee had expressed disagreement with the views of the Association; and the Chairman had been deputed to deal with the communication at his discretion.

Large Gas Consumption in Birmingham.—The Gas Committee of the Birmingham Corporation have lately been passing through a time of great stress. In common with other gas producers, and with most large consumers of coal, they are experiencing considerable anxiety owing to the difficulty of getting supplies. This may be readily understood when it is stated that the winter consumption is about 15,000 tons per week. Concurrently with this check to the delivery came a largely-increased demand for gas. In the week ending the 14th inst., the total output was 185½ million cubic feet, or nearly 11 millions more than the previous highest weekly delivery, which took place in the week ending Dec. 24, 1896, and reached 174,820,000 cubic feet.

Bilston Gas Company.—In the report the Directors of this Company will present at the general meeting to be held on the 1st prox., they state that the profit and loss account, after paying the usual interim dividend, shows a balance of £4323 17s. 10d. From this amount, it is proposed to pay dividends of 5s. 6d. and 4s. per share on the "A" and "B" shares respectively; making, with the interim dividends, 11s. and 8s., for the year, and leaving a balance of £1638 17s. 10d. The Directors report that during the year there has been an increase in the sales of gas of 8 million cubic feet, due partly to the extended use of prepayment meters, and partly to the general demand for gas for lighting and power purposes. Among the improvements made in the plant has been the provision of coal-breaking and stoking machinery, which it is anticipated will lead to economy in the manufacture of gas.

Messrs. Frost and Dye, of Hertford, have taken the Welwyn Gas-Works (Herts), lately in the occupation of Messrs. J. Deards and Son.

A number of men engaged at the gas-works of the North-Eastern Railway at Gateshead have struck for an advance of 6d. a day and 1s. 6d. a week bonus for "good time-keeping."

The total expenses incurred by the Gainsborough Urban District Council in the promotion of the Gainsborough Gas Bill in the last session of Parliament are stated to have been nearly £1000.

It will be seen by an announcement which appears elsewhere that the Directors of the Crystal Palace District Gas Company are inviting tenders for £20,000 of 5 per cent. perpetual debenture stock, under the provisions of their Act of 1893. The minimum price is £150 per cent.; and the tenders are to be sent in by the 18th prox.

In view of the prices charged for incandescent gas-mantles, it has often been a matter of wonder why some means were not taken to preserve the ashes and fragments of broken mantles for re-use. We now learn that the firm of Oberfelt and Co., of 105, Alexandrinenstr., Berlin, are open to purchase this hitherto waste material, with the object of extracting from it the oxides of the rare earths, and so recovering the thorium for use in the manufacture of new mantles.

As the result of forty years' experience as manufacturers of gas-stoves, Messrs. John Wright and Co. have found that the principal cause of complaint has been that the stoves have been improperly fixed and often injudiciously selected. With the view of removing all obstacles to the further use of gas for cooking and heating purposes, they have issued a neatly-printed pamphlet giving consumers a few useful hints (compiled by Mr. G. F. Glenny, their London Manager) on selecting and fixing gas-fires.

The Directors of the London Hydraulic Power Company are preparing a Bill for next session, which, if sanctioned, will enable them to extend their operations into any part of the Metropolis without the consent of the Local Authorities. By their Act of 1884, the Company are placed under an obligation to obtain the consent of the then Metropolitan Board of Works, and the Vestry or District Board of any parish or parishes within the Metropolis, before any pipes can be brought within the jurisdiction of these bodies. We learn that it is proposed to repeal the Act so far as it relates to the powers vested in these bodies.

At the West Riding Assizes, on the 8th inst., before Mr. Justice Grantham and a jury, a case was concluded in which Mr. Thomas Redman, a gas lighting engineer of Bradford, sought to recover £267 19s. 9d. from Thomas Walter Barber, a civil engineer of London. Transactions had taken place between the parties with reference to the Anti-Vibration Incandescent Lighting Company, Bradford, which went into liquidation. Plaintiff, with defendant's assistance, acquired it from the Liquidator, and it was afterwards taken over by a Leeds Syndicate. When the time came for the settlement of accounts as between plaintiff and defendant, complications and disputes arose. There was a counter-claim by the defendant for £500 for breach of agreement. The Jury found for the plaintiff on both the claim and counter-claim.

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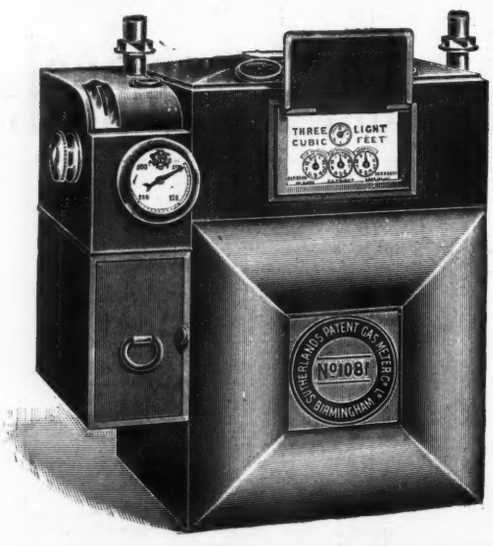

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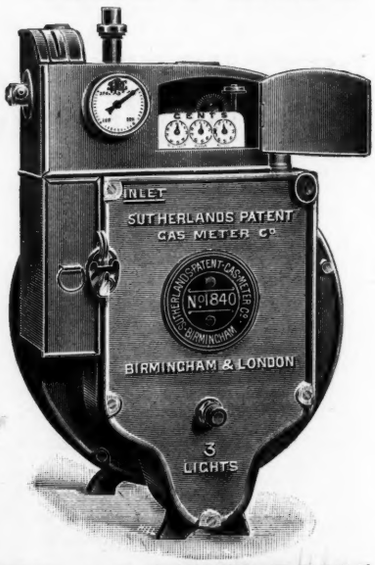

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[For Illustrated Advertisement, see Dec. 5, p. 1400.]

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THE MAGISTRACY OF COPENHAGEN.

Dec. 19, 1899.

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GASHOLDER.

CONTRACT No. 2.

THE Gas and Water Committee of the above Council are prepared to receive TENDERS for the Manufacture and Erection of a STEEL TELESCOPIC GASHOLDER, 80 feet diameter, with Guide-Framing and Inlet and Outlet Pipes.

Copies of the Specification, Form of Tender, and Drawings may be obtained from the Engineer, Mr. Sydney Francis, Town Hall, Clacton-on-Sea, on payment of Two Guineas, which will be returned on receipt of a *bonâ-fide* Tender.

Sealed Tenders, endorsed "Tender for Gasholder," to be delivered to the undersigned not later than Twelve o'clock noon on Monday, Jan. 8, 1900.

The Committee do not bind themselves to accept the lowest or any Tender.

GEO. T. LEWIS, Clerk.

Town Hall Buildings, Clacton-on-Sea, December, 1899.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of—

1. WROUGHT-IRON GOODS,
2. STOKERS' GLOVES,
3. IRONMONGERY,
4. STEEL GOODS,
5. FIRE-CLAY GOODS,
6. IRON VALVES and CONNECTIONS,
7. WET and DRY METERS,
8. HORSE CORN,
9. TARRED GASKIN, &c.,

Required during the ensuing Twelve Months.

Forms of Tender and further Particulars may be obtained on application to Mr. Thomas Holgate, C.E., Gas Engineer, Halifax.

Tenders, properly endorsed, to be sent to the undersigned before Ten o'clock a.m. on Wednesday, the 3rd of January, 1900.

The persons whose Tenders are accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tenders.

By order, KEIGHLEY WALTON, Town Clerk.

HAWORTH URBAN DISTRICT COUNCIL.

TENDERS are invited for the purchase of the Council's surplus TAR and LIQUOR for the Year ending Dec. 31, 1900, delivered on Rails at Haworth Station.

Tenders to be sent to me not later than Dec. 28, 1899.

WM. ROBERTSHAW, Clerk.

Burlington Chambers,
North Street, Keighley.

SKIPTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR OXIDE OF IRON.

THE Council invite Tenders for the supply of 100 Tons of Natural OXIDE OF IRON, to be delivered at the Gas-Works, Skipton, free of carriage.

Sealed Tenders, stating times of delivery, are to be sent to me on or before Tuesday, Jan. 9, 1900.

The Council do not bind themselves to accept the lowest or any Tender.

RICHARD WILSON, Clerk to the Council.

Dec. 21, 1899.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO ENGINEERS AND IRONFOUNDERS.

THE Directors of this Company invite TENDERS for the supply, delivery, and erection of CONVEYORS and ELEVATORS at their Neepsend and Effingham Street Stations:—

A CONVEYOR and ELEVATOR for Settling Tank at their Neepsend Station.
An OXIDE ELEVATOR for Purifying-House at their Neepsend Station.
An OXIDE ELEVATOR and ENGINE for Purifying-House at their Effingham Street Station.

Drawings may be seen and Specification obtained, on and after Dec. 20, upon application to the Engineer, Mr. J. W. Morrison, at the Company's Offices, Commercial Street, Sheffield.

Sealed Tenders, endorsed "Tender for Elevator," must be delivered (by post) at the Company's Offices not later than the first post on Tuesday, the 2nd day of January next.

The Directors do not bind themselves to accept the lowest or any Tender.

HANSBURY THOMAS, General Manager and Secretary.

Commercial Street, Sheffield,
Dec. 16, 1899.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m., on Tuesday, the 2nd day of January next, and will be RE-OPENED immediately after the Half-Yearly General Meeting of the Company, to be held on the 2nd day of February next.

By order,
JOHN WILLIAM FIELD, Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Dec. 22, 1899.

CRYSTAL PALACE DISTRICT GAS COMPANY.

SALE BY TENDER OF £20,000 FIVE PER CENT. PERPETUAL DEBENTURE STOCK.

MINIMUM PRICE, £150 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL, BY TENDER, £20,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the provisions of the Crystal Palace District Gas Act, 1893 (56 and 57 Vic.).

Particulars of same, with Form of Tender, can be obtained at this Office on application to the undersigned; and Tenders must be sent in on or before Thursday, the 18th day of January, 1900.

The Stock will be allotted to the highest bidders; but no Tender will be accepted at a lower price than at the rate of £150 money for each £100 Debenture Stock.

By order of the Board,
CHARLES M. OHREN, Secretary.

Offices and Works: Lower Sydenham, S.E.,
Dec. 15, 1899.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GUILDFORD GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 600 £10 ADDITIONAL ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 16th of January, 1900, at Two o'clock.

Particulars of the AUCTIONEER, as above.

ESTATE OF WILLIAM BOARDS, ESQ., DECEASED.

THE Sale of Shares in the West Ham Gas Company and the Bournemouth Gas and Water Company advertised to take place on the 16th of January, IS POSTPONED till a later date.

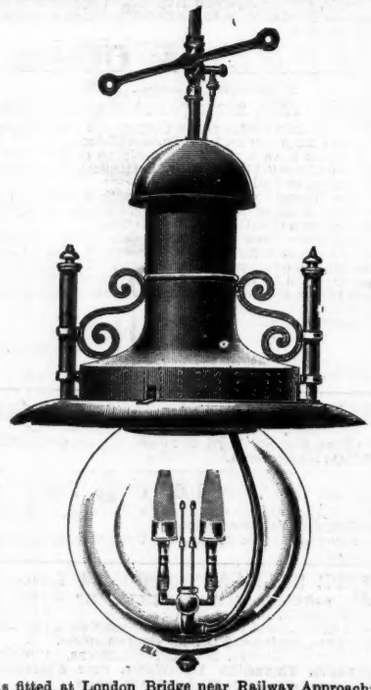
Mr. ALFRED RICHARDS, Auctioneer, 18, FINSBURY CIRCUS, E.C.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.

The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.

Apply to the Sole Makers:
THE WHESSOE FOUNDRY COMPANY, LIMITED DARLINGTON.

THE PATENT
"BEACON" GLOBE LAMP.



As fitted at London Bridge near Railway Approach; three Lamps giving the Illuminating Power of 600 Candles. See Surveyor's Report as published in the "*JOURNAL*" for Jan. 10, 1899.

H. GREENE & SONS, Ld.
Late of Cannon Street,
19, FARRINGDON ROAD, E.C.
Telegrams: "LUMINOSITY, LONDON."

GAS PLANT New or 2nd Hand Equipments for Coal Gas, Water Gas, Oil, Acetylene, Coke Oven, and Blast Furnace Gas.
POWER or LIGHT WORKS.
Also **VALUATION** Consultation, Inspection, & Expert Reports.
JAS. WRIGHT, M.I.M.E. BRIDGE HOUSE, BLACKFRIARS, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

Half Bound Morocco. Post 4to. 15s.

Municipal Electricity Supply,
COMMERCIAL AND BUSINESS ASPECTS OF.
A Practical Handbook for the use of Municipal Electrical Engineers and Members of Municipal Electricity Committees.
BY
A. H. GIBBINGS, M.I.E.E.,
Electrical Engineer to the City of Bradford.

Catalogue of Technical Books Post Free.

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NITRATE of Thorium and Cerium.
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FIRE-CLAY & BRICK WORKS,
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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.
LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS
FROM THE
LONDONDERRY COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR,
COUNTY OF DURHAM.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	16 1/10 Stand. Sperm. Candl.
Coke (of good & pure quality)	13¾ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.
Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS-FITTINGS.
BURNERS
Welsbach Pattern
per 7/6 Doz.
WRITE FOR CATALOGUE.
WHOLESALE
FITTINGS COMPANY
80, Commercial Road,
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INCANDESCENT

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for
CANNEL & COAL.
TYNE
BOGHEAD
CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles
Coke per ton	1,301·88 lbs.

EAST PONTOP
GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN
GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

THOMAS TURTON
AND SONS, LIMITED,
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FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
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ANVILS, VICES,
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WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.
Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— *LIMITED.* —
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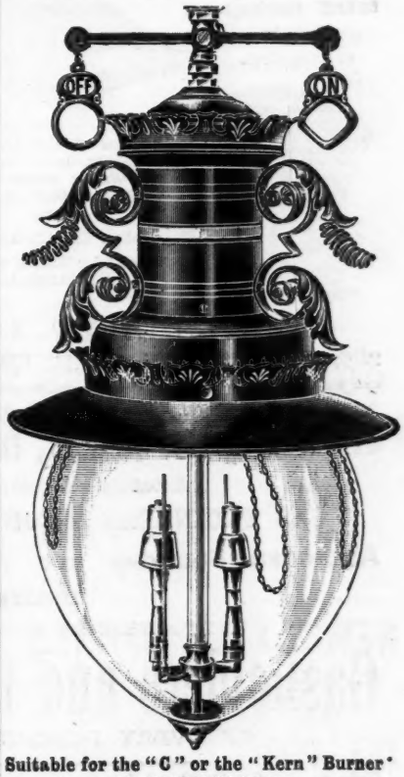
THE
"Matchless" Arc Lamp.


Suitable for the "C" or the "Kern" Burner.
PRICE LIST ON APPLICATION.
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THE CHEMISTRY OF ILLUMINATING GAS.

By NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

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WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.

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SUPPLY FROM STOCK

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AND ALL KINDS OF GAS-WORKS APPARATUS.

SOCKET-PIPES FOR GAS OR WATER PURPOSES.

FLANGE PIPES FOR STEAM.

Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.

AGENTS FOR

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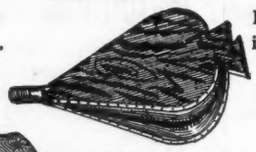
THOMAS BUGDEN,

Manufacturer of

Bellows for Inflating Gas-Bags. Made in various sizes.



Bellows made to inflate a 48-inch Bag under One Minute.

Miners' Woollen Jackets.

India-rubber Hose, Sheet, and Washers of every description, Leather Bands, Oils, &c., Diving and Wading Dresses, Waterproof Coats, Capes, and Sewer Boots.

Stokers' Mitts, from 14s. doz.

Special Air Tubing made for Gas Companies.

Gas-Bags for Mains.

71, GOSWELL ROAD, E.C., AND AT

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WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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MACHINE-MADE GAS-RETORTS.

PETTIGREW'S PATENT

Sulphate of Ammonia Plant

ON THE CONTINUOUS SYSTEM

Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

Old Systems easily and cheaply converted.

ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

Makers of Self-Emptying Saturators.

Write for Particulars, Testimonials, and References to

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Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

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[See Illustrated Advertisement, Dec. 5, p. 1402.]

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OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

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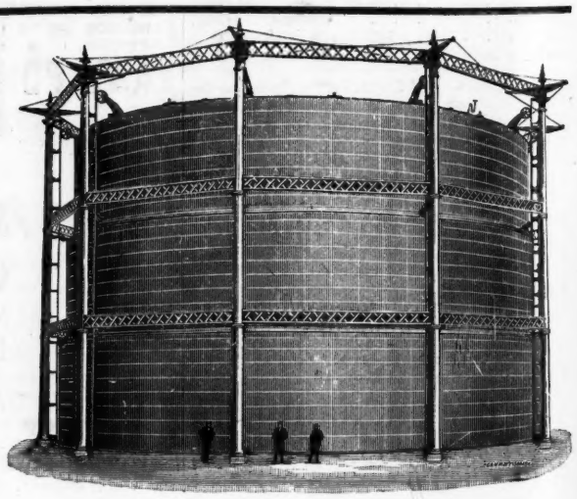

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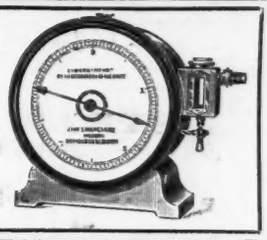
MILTON HOUSE WORKS EDINBURGH.
LONDON. —— LEEDS. —— GLASGOW.



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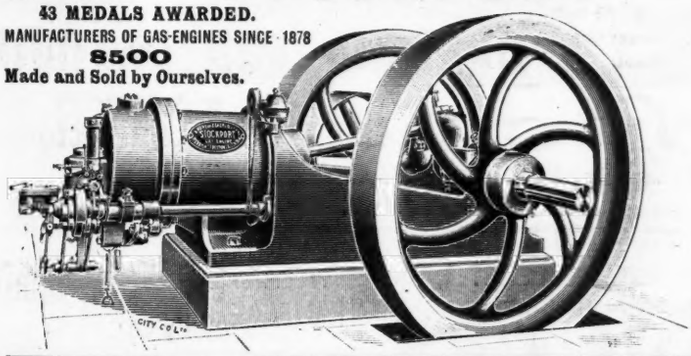
G. R. HISLOP'S Patent Improved Lime Revivifying Apparatus.

SPENT LIME as carbonate is RESTORED at a cost considerably under that of New Lime, and that WITHOUT LIMIT to its DURABILITY, and with UNIMPAIRED EFFICACY as a Purifying Agent. The LIME is RESTORED on the PREMISES; ECONOMY of SPACE is SECURED by the non-accumulation of Spent Lime—thus SAVING all TROUBLE and EXPENSE in the disposal of the Lime as waste. The PROCESS can be USED in any LOCALITY without becoming a nuisance. Enquiries respectfully solicited. Full Particulars from Messrs. SAMUEL WHILE & SON, 60, Queen Victoria Street, LONDON, E.C.; or from the Principal Agent, R. F. HISLOP, F.C.S., Gas Engineer, Craigielea, PAISLEY.

NEW DESIGN "STOCKPORT" GAS-ENGINES

43 MEDALS AWARDED.
MANUFACTURERS OF GAS-ENGINES SINCE 1878
8500
Made and Sold by Ourselves.



With Otto Cycle and our own Patented Improvements.
All Sizes from 1½ H.P. to 250 Brake H.P.

SEND FOR LATEST PRICE LIST.

The Greatest Brake H.P. given for the Smallest Gas Consumption.
SIMPLE IN EVERY DETAIL.

J. E. H. ANDREW & CO., LTD.
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DEPÔTS IN ALL THE PRINCIPAL TOWNS.

MOBBERLEY & PERRY STOURBRIDGE.

Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
London Agents: Contractors for the erection of Retort-Benches complete.

BALE & HARDY, Gas Engineers and Contractors. BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

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"KITSON" LIGHT

A SYSTEM OF BURNING VAPOURIZED PETROLEUM WITHIN AN INCANDESCENT MANTLE.

A Light of 1000-CANDLE POWER produced at a cost of less than

ONE PENNY PER HOUR.

STREET-LAMPS—Self-Contained Plant, easily fixed, no tearing up of Thoroughfares.

INSTALLATIONS for Works, Factories, Warehouses, Railway Stations, and Sidings.

SPECIAL TERMS TO GAS COMPANIES.

FOR PRICES AND PARTICULARS, APPLY TO THE

KITSON LIGHTING & HEATING SYNDICATE, Ld

1, VICTORIA EMBANKMENT (New Bridge Street), LONDON, E.C.

REGISTERED OFFICE: 137, Victoria Road, DARLINGTON.

GASHOLDER TANK, EMBANKMENT, & RAILWAY

Telegrams: "Robustness, London."

UNDER CONSTRUCTION BY OUR OWN WORKMEN.

Telephone No. 756 Bank.

RESERVOIRS, TRIAL BOREHOLES and WELLS. MAIN and SERVICE LAYING.

COMPLETE GAS and WATER WORKS ERECTED and SET to WORK including ALL MAINS.

J. & H. ROBUS, Engineering Contractors,

20, BUCKLERSBURY, LONDON, E.C.

For Carbonizing Advt., see last Issue.

LONDON OFFICE:

TELEGRAPHIC ADDRESS: "DRAKESON, HALIFAX."

34, VICTORIA ST., WESTMINSTER, S.W.

TELEPHONE No. 43 "HALIFAX EXCHANGE."

GAS ENGINEERS. CONTRACTORS. IRONFOUNDERS.

RETORT SETTERS. FURNACE BUILDERS. ETC. ETC.

JONAS DRAKE & SON

SOLE AGENTS FOR

HISLOP'S

PATENT REGENERATIVE FURNACES

— FOR —

ENGLAND, WALES & ABROAD.

RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.

RESULTS GUARANTEED.

OVENDEN HALIFAX

Designs and Estimates on Application.

GASEOUS FIRING A SPECIALTY.

We are showing at the Gas and Allied Trades Exhibition, Royal Aquarium, Westminster, Dec. 21 to Jan. 23, Stands Nos.: Area, 26 and 26a; Gallery, 39.

"SIMPLEX" CHIMNEYLESS BURNER

Manufactured under the De Mare MASTER Patent and subsequent Minor Patents.

SEE CAUTION BELOW.

IN THREE SIZES, as follows—

No. 2.
COTTAGE SIZE.

No. 3.
FOR SHOP AND INTERIOR LIGHTING.

No. 4.
STREET LIGHTING.

With SUNLIGHT WHITE MANTLE.

The "Simplex" is fitted with a Removable Cap and an Air-Adjusting Ring, making it quite easy for anyone to adapt the Burner to the varying Pressures and Qualities of Gas in different parts of the country.

The "Simplex" Burner is so constructed as to make the light practically shadowless; and this, coupled with the fact that it is of a much more artistic shape, gives it an enormous advantage over the very unsightly competing infringement for the moment on the market.

Maximum Light (without artificial pressure) 125 Candle Power.

CAUTION! CAUTION!! CAUTION!!!

INCANDESCENT GAS LIGHTING.

All Dealers and the Public are **CAUTIONED** against Buying, Selling, or Using **"NEW WELSBACH"** (commonly known as the **"KERN"**) **BURNERS.**

ACTIONS FOR INFRINGEMENT OF PATENT HAVE BEEN COMMENCED by the **NEW SUNLIGHT INCANDESCENT COMPANY, LIMITED,** against the **WELSBACH COMPANY** for Infringement of the **DE MARE PATENT** by the **MANUFACTURE AND SALE** of such Burners, and are about to be commenced against Dealers and Users for Infringement of our Patent in respect of their Sale or Use. **USERS** are equally liable with **DEALERS.**

NEW SUNLIGHT INCANDESCENT CO., LTD.

33-34, SHOE LANE, LONDON, E.C.

MAURICE GRAHAM. Telegrams "ACCOUPLE" LEEDS.

GRAHAM, MORTON & Co. LTD.

CONTRACTORS TO H.M. GOVERNMENT.
SEE OUR ILLUSTRATED CATALOGUE

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Works; BLACK BULL STREET, LEEDS.

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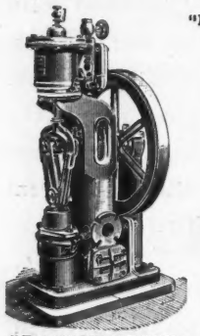

"Fig. 705. SINGLE RAM" STEAM-PUMP.

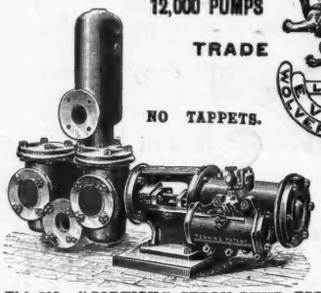

Fig. 592. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

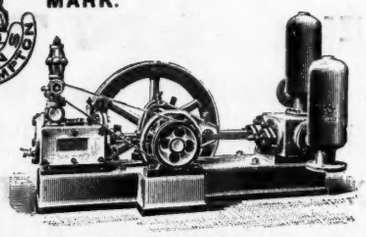

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

ESTABLISHED 1844. ORIGINAL MAKERS. ESTABLISHED 1844.

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

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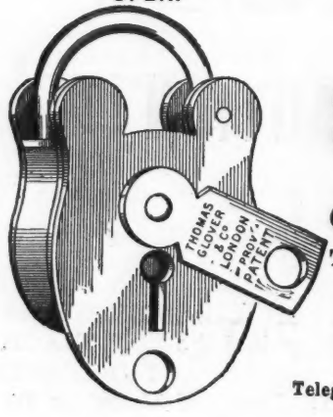

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BIRMINGHAM: 1, OOZELLS STREET. *Telegraphic Address:* "GOTHIC."

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address:* "GOTHIC." Telephone No. 3598.

GLASGOW: ARGYLE WORKS, KINNING PARK. *Telegraphic Address:* "GASMAIN." Telephone No. 1525 South Side.

PUBLIC CAUTION!

The Trade and the Public are warned against the

INFERIOR IMITATIONS OF THE NEW WELSBACH (KERN) BURNER

lately placed upon the Market. All **DEALERS** and **USERS** of the

NEW WELSBACH (KERN) BURNER

are requested to ignore the Newspaper Threats of the New Sunlight Incandescent Company, Limited, and, in case of an Action being brought, to at once communicate with the Welsbach Company, who, upon receipt of the Writ, are prepared to take the Defence of the Action into their own hands, and to Indemnify the person attacked from all consequences.

MANTLES.

DEALERS and **USERS** are also **WARNED** not to believe the rumours circulated by Infringers, that the Company's Patent Rights expire shortly. These rights

EXIST UNTIL 1907;

and the Company will continue to uphold their rights, and to Suppress all Infringements of Mantles as well as of Burners.

The Company are doing their best to accelerate the Action now pending in respect of the

SUNLIGHT COMPANY'S WHITE MANTLE,

which, it is claimed, is an

INFRINGEMENT OF THE WELSBACH PATENTS.

Dealers and the Public are cautioned against Buying, Selling, or Using the said Mantle.

It is also claimed that

THE VOELKER MANTLE,

submitted to, and refused by, the Company, is an

INFRINGEMENT OF THE WELSBACH PATENTS;

and an Injunction will be applied for in respect of this Mantle also should it ever be placed on the Market.

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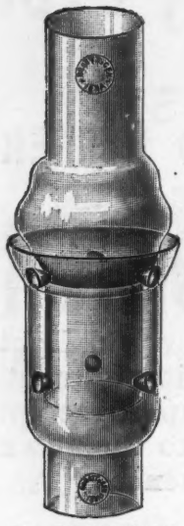

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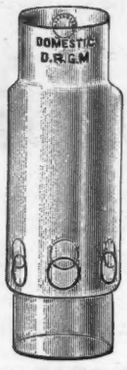
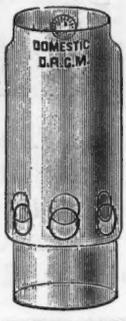


"THE NORMAL" for Street Lighting.



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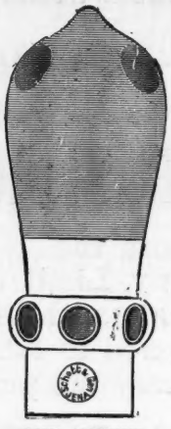

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ALL THE

Gas Engineers who are considering the introduction of Inclined Retorts and Coal Handling Machinery would do well to get permission of B. W. Smith, Esq., to inspect the installation of

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which we have completed for the Urban District Council of Smethwick, and of which the Chairman of the Gas Committee, John Stones, Esq., says they "are a GREAT CREDIT to all concerned, and MOST SATISFACTORY" to himself. We manufactured the whole of the Ironwork and Machinery, except the Gas-Engine,

AT

our own Works, and the Settings also are of our own special design. Go to

SMETHWICK

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The only System actually giving over

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Three Burners consuming 30 cubic feet per hour give a Light of 1000-Candle Power at half the cost of Electric Light.

Specially adapted for Lighting Railway Stations, Docks, Sheds, Workshops, Streets and Squares, Shop Windows, &c., &c.

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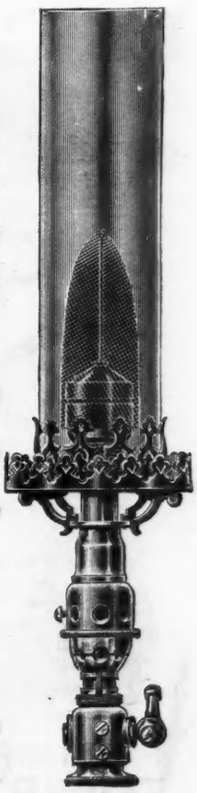

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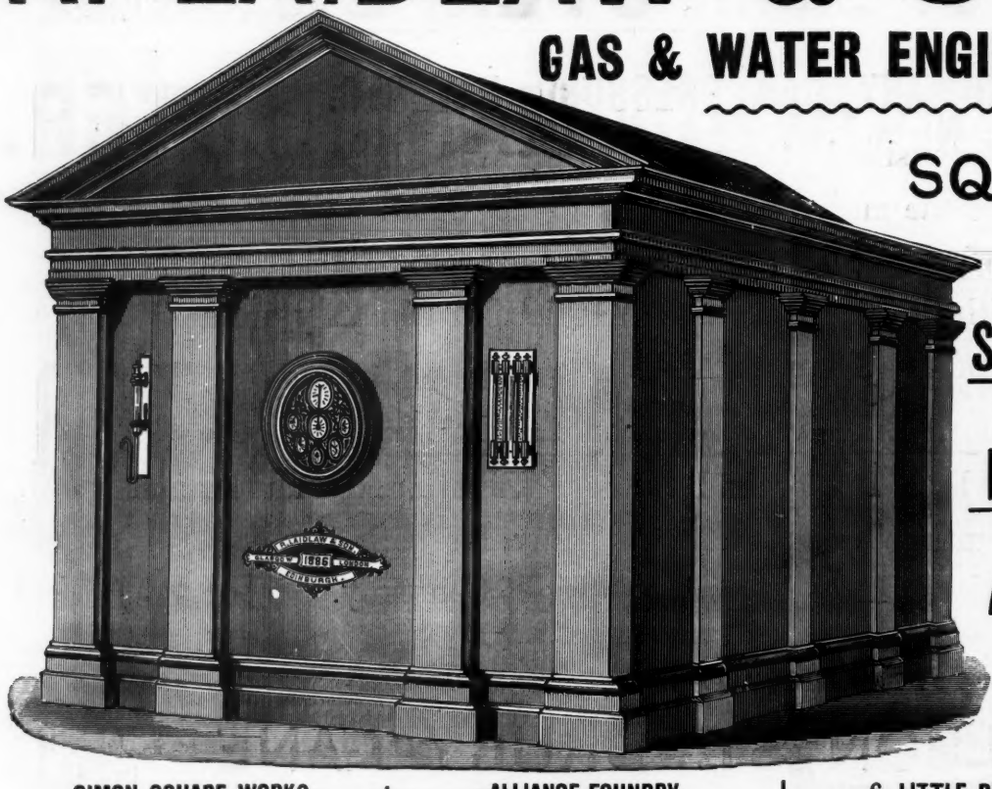

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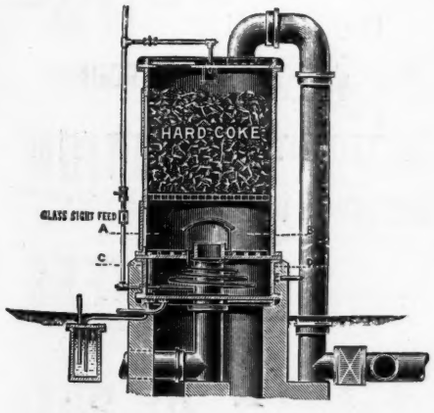

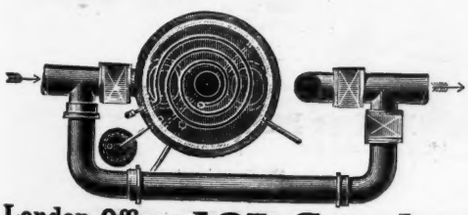

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FOR ENRICHING COAL GAS, AND FOR

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[See also Advt., p. 1538.

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THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

Vol. LXXIV. No. 1911.] LONDON, DECEMBER 26, 1899. [51st Year. Price 6d.

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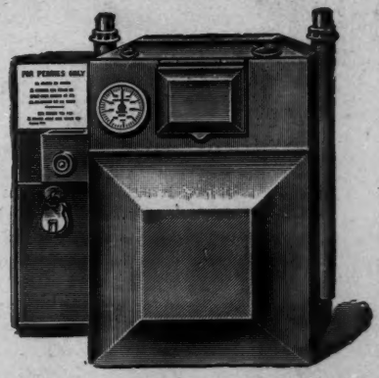
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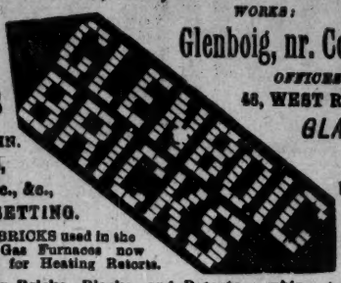

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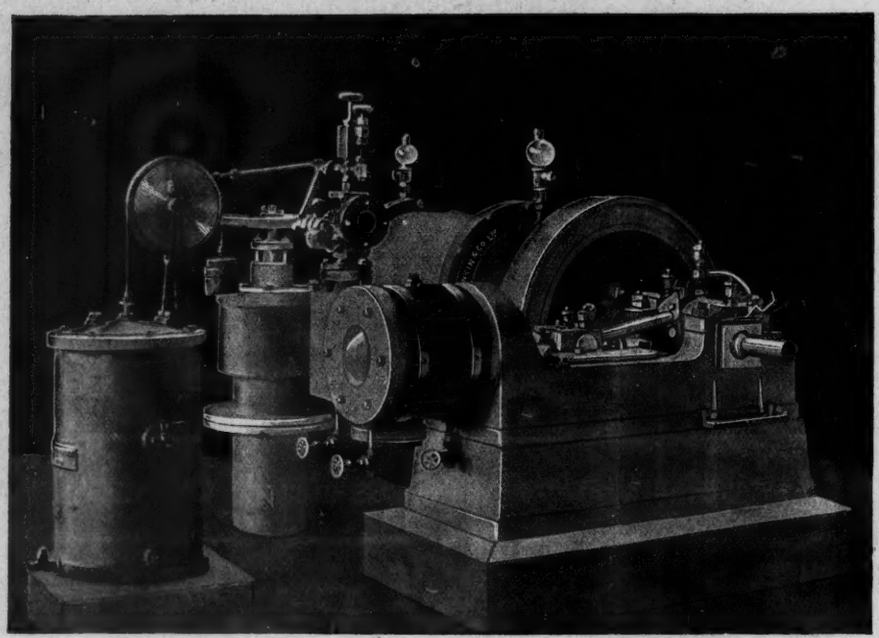
Standard Test-Meters,	Chemical Apparatus,	Water-Gas Photometers.

GAS EXHAUSTING PLANT.

Very Compact. — On One Base-Plate. — Very Little Steam Required.



Workmanship and Finish of the very best description. — Will run for ten to fourteen years without any Expensive Repairs.

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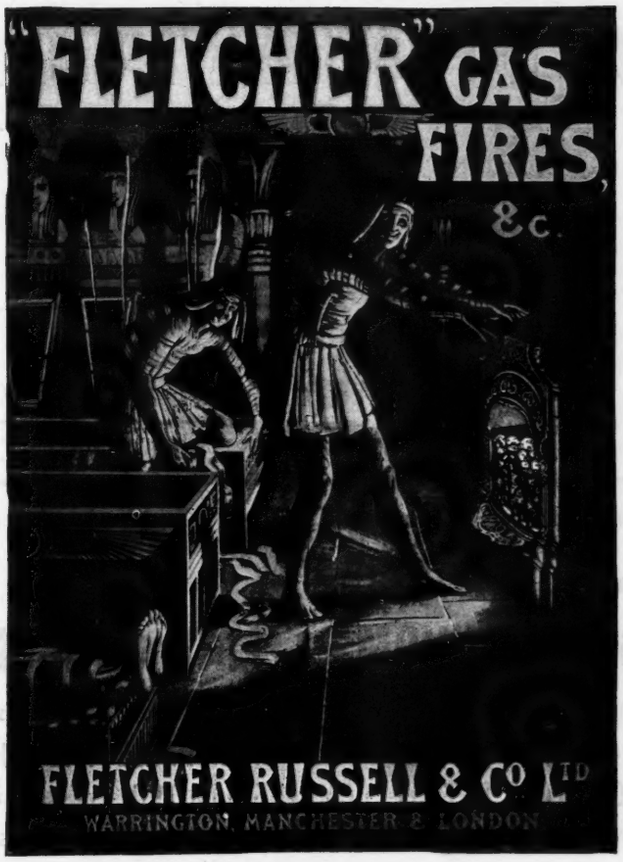
THE Newest Designs.



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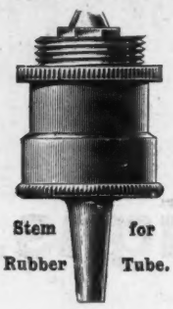
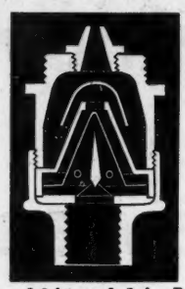
Top of GOVERNOR SCREWS Direct into Tube of BURNER, and is tapped to receive Incandescent Company's Nipple.



Stem for Rubber Tube.

Requires only $\frac{3}{10}$ths higher pressure than is necessary to pass the Gas through Nipple without a Governor.



Tapped $\frac{3}{8}$ in. and $\frac{7}{16}$ in. Brass.

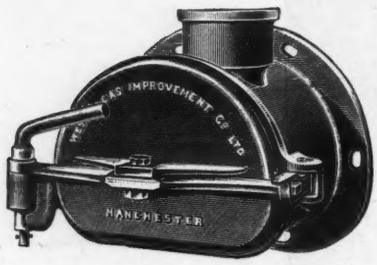
Most Satisfactory and RELIABLE GOVERNOR on the Market.

Hexagon Tapped $\frac{3}{8}$ in. and $\frac{1}{2}$ in. Iron.

D. BRUCE PEEBLES & CO., TAY WORKS, EDINBURGH.

WEST'S GAS IMPROVEMENT COMPANY, LTD.

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER;
AND 104, QUEEN VICTORIA STREET, LONDON, E.C.



MAKERS OF WEST'S MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS.

WEST'S PATENT REGENERATOR SETTINGS.

WEST'S PATENT SILENT COKE CONVEYOR.

RETORT MOUTHPIECES WITH SELF-SEALING LIDS.

A NEEDFUL NOTICE

TO ALL WHOM IT MAY CONCERN.

We hereby intimate to Chairmen and Members of Gas Committees, Engineers and Managers of Gas-Works, that we have **PURCHASED THE BUSINESS AND PATENTS OF THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED,** Westminster, London, and are now the Sole Owners of the Patents of the pre-eminently successful system of Self-Acting Conveyors and Elevators in combination with the Storage Hoppers, the Measuring Chambers, and the Charging-Shoots, forming together the much admired and happily-designated "powder-pouch" method of charging Inclined Retorts, now in operation, or in course of erection, at—

Aberdeen,	**Cambridge,**	**Leeds,**	**Nine Elms,**
Batley,	**Chesterfield,**	**Leigh,**	**Rotherham,**
Bow Common,	**Coventry,**	**Manchester,**	**Smethwick,**
Brentford,	**Dewsbury,**	**Middlesbrough,**	**Todmorden,**
Brighouse,	**Dudley,**	**Middleton,**	**Wakefield,**
Burnley,	**Gateshead,**	**Nelson,**	**West Hartlepool, &**
Burslem,	**Huddersfield,**	**Newcastle,**	**Wolverhampton.**

PLEASE ADDRESS:

NEW CONVEYOR CO., LTD., SMETHWICK.

IMPROVED SERVICE CLEANSER

FOR SPECIALLY DEALING WITH

NAPHTHALENE.

(HERBERT JONES' PATENT, No. 14,634.)

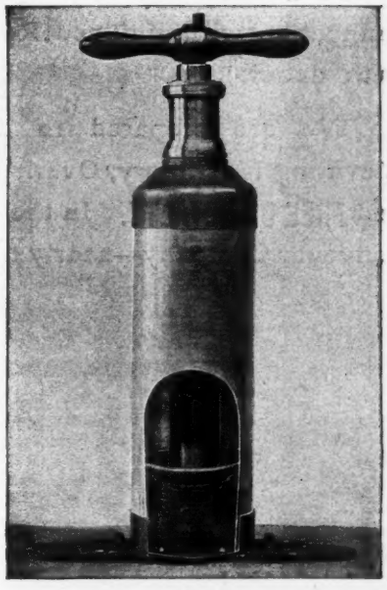
Trade List

£3 5s.

Net.

2½ per cent.

Cash Monthly.



Advantages.

This Cleanser is thoroughly effective in removing stoppages of all kinds, but in practice has been found to be particularly so in cases where Services are choked with Naphthalene.

It is less expensive to Companies, as it overcomes the necessity for repeated operations; and further it reduces the inconvenience to Consumers to a minimum by more thoroughly cleansing the pipes than is done with simply an Air-Blast.

It can, however, be used as an ordinary force-pump, without alteration, by simply omitting the charge.

It is light and compact.

INSTRUCTIONS FOR USE.

Unscrew the plug on the shoulder of the Pump, and pour in a charge of (say) from ¼ to ½ pint of Petroleum Spirit 680-700. Replace the plug, and proceed as with an ordinary Service Cleanser.

THOMAS GLOVER & CO., LTD.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

Telegraphic Address: "GOTHIC, LONDON." **Telephone No. 725, Holborn.**

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Telegraphic Address: "GOTHIC."
Telephone No. 3898.

GLASGOW:
ARGYLE WORKS, KINNING PARK.
Telegraphic Address: "GASMAIN."
Telephone No. 1325 South Side.

A "NEEDFUL" EXPLANATION.

We note an Advertisement in the "JOURNAL," under the name of the NEW CONVEYOR COMPANY, stating that they had taken over the business of the AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED; and, as it may create a false impression, we beg to say there are **NO VALID PATENTS** existing in connection with Inclined Retorts (beyond a few small and subsidiary ones, dealing with details).

We are prepared to erect Inclined Retort Plants, with Conveying and Elevating Machinery, Overhead Tanks, Hoppers, and Measuring Chambers, complete and **FREE OF ROYALTY.** In the list of places given, only a few were erected by the New Conveyor Company—nearly all the remainder being erected by the undersigned.

JONAS DRAKE & SON, OVENDEN, HALIFAX.

GRAHAM, MORTON, & CO., LIMITED, LEEDS.

W. J. JENKINS & CO., LIMITED, RETFORD.

WINSTANLEY COMPANY, COVENTRY.

BRADDOCK'S NEW PATENT

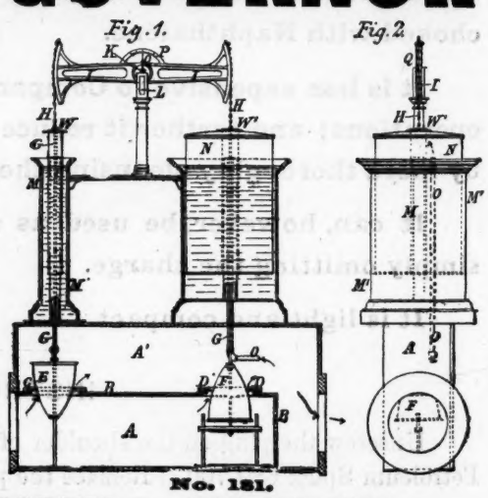
GAS STATION GOVERNOR

GIVES A STEADY OUTLET PRESSURE UNDER ALL CONDITIONS AND AT ALL TIMES.

OVER 80 (4 in. to 36 in. inclusive) SUPPLIED.

THE BEST GOVERNOR OBTAINABLE.

Most compact and convenient.
Unsurpassed for Durability,
Efficiency, and Reliability.



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WHEN THE GOVERNOR IS FITTED WITH

BRADDOCK'S PATENT "SELF-LOADING" APPARATUS

The outlet pressure is automatically and gradually varied, within any predetermined and fixed limits, according to the demand for gas being small or large.

First Cost soon saved. A proved success. Repeat Orders received.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, **OLDHAM,**
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Telegrams: "BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

W. & B. COWAN'S DRY METERS.

Meter in Tin-plate Case.

Meter in Cast-iron Case.

THESE are constructed of the best charcoal tinned plates, and the diaphragms of the best Persian sheepskins, specially selected and prepared. The diaphragm is tied with Bessemer steel wire, between which and the leather a band of flax webbing is interposed, so as to protect the latter. By this means leakage at the tying is rendered impossible.

Leakage at the index box is effectually prevented by the adoption of a grease cup in connection with the ordinary stuffing-box. A prolonged experience of this modification which we introduced in 1878, justifies its recommendation as a substantial improvement.

Excepting as regards the cases, the above remarks apply equally to the Patent Improved Cast-Iron Cased Dry Meters, the essential feature of which is that all the internal fittings are *exactly similar* to those of tin-cased Dry Meters; and it is therefore impossible for rust or other foreign substance to come in contact with the valves, as it is liable to do in iron dry meters as ordinarily constructed.

All the sizes of these Meters are of neat design, and are unexcelled for workmanship, material, and finish. The most careful supervision is exercised at every stage of their manufacture, and only the highest class of skilled labour is employed.

Large Stocks always Ready for Immediate Delivery, or for Shipment.

W. & B. COWAN, LTD.

ESTABLISHED 1827.

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THE GAS METER COMPANY, LIMITED.

WORKS: LONDON, OLDHAM, DUBLIN.

See also Advt. page 1536.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS-METERS.

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THE COMPANY MANUFACTURE TWO KINDS OF

PREPAYMENT METERS.

1st. VALON'S PATENT STOP METER.

2nd. THE "MUTUAL" COIN PENNY-IN-THE-SLOT METER.

WITH LEVER ON TOP OR SIDE AS PREFERRED.

MADE TO TAKE PENNIES, SHILLINGS, OR ANY FOREIGN COIN.

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THE WORLD-FAMED

PEEBLES' NEEDLE BURNERS

AND

PENNY-IN-THE-SLOT GAS-METERS.

Great success has attended the adoption of the above combination; and in consequence we are supplying large quantities of our "**Needle Burners**" to Gas Companies and Corporations who recognize the advantage to be gained by adopting the **best Governor Burners**, set to consume a certain quantity of Gas per hour. Many Gas Companies give the **Peebles Burners** along with the Fittings free of charge; while others advise Consumers to buy them for their own satisfaction, knowing that, by doing so, they will get full value for their Pennyworth of Gas.

D. BRUCE PEEBLES & CO., Tay Works, EDINBURGH.

Preservation of Ironwork.

"FERRODOR" ELASTIC PAINT

(NON-POISONOUS).

Mr. ROBERT BEYNON (TORQUAY GAS-WORKS) writes:

"I have used '**FERRODOR**' **PAINT** for coating the side plates of our **PURIFIERS**, for the **TOP SHEETS** of a **GASHOLDER**, and for the **IRONWORK** for a **RETORT-HOUSE ROOF.** It is, in my opinion, the **BEST PAINT** in the Market for these purposes."

SPECIAL PAINT FOR GAS-METERS.

"VITROS" the only reliable coating for DRINKING-WATER TANKS (Non-Poisonous).

GRIFFITHS BROS & CO., MACKS ROAD, BERMONDSEY, LONDON.

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ARTESIAN BORED TUBE WELLS

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